Preserving

Groundwater Quality Survey and Contaminant Trends Study Report

2025 Report

THE MIAMI CONSERVANCY DISTRICT

Abstract

The Miami Conservancy District (MCD) conducted a groundwater monitoring program in 2025 to assess water quality across 14 monitoring wells within the buried valley aquifer system of the Great Miami River Watershed. Sampling was performed in spring and fall, and analyses included E. coli, major ions, metals, nutrients, and per- and polyfluoroalkyl substances (PFAS). Results indicate that six wells met all human-health benchmarks, while the remaining wells exhibited elevated concentrations of E. coli, iron, manganese, nitrate-N, and select PFAS compounds, along with elevated sodium and chloride levels in some cases. The study highlights the influence of anthropogenic activities on groundwater quality and underscores the importance of ongoing monitoring, land-use management, and adaptive strategies to protect public health and aquifer integrity.

Executive Summary

Since 2014, the Miami Conservancy District (MCD) has monitored groundwater quality to evaluate the impacts of human activities on the buried valley aquifer system and identify potential risks to public health and the environment. In 2025, MCD collected samples from 14 monitoring wells during spring and fall to analyze for a suite of parameters, including E. coli, major ions, metals, nutrients, and PFAS.

Results show that six wells met all applicable human-health benchmarks. However, concentrations of E. coli, iron, manganese, nitrate-N, and PFAS compounds (including PFOA and PFOS) exceeded standards in other wells. Elevated sodium and chloride were also observed, reflecting anthropogenic sources such as road salt, fertilizers, wastewater, and industrial activities. Seasonal and redox-related fluctuations influenced iron and manganese concentrations, while groundwater-surface water interactions may have contributed to PFAS detections at some sites.

Overall, the findings underscore the vulnerability of shallow, unconfined sand and gravel aquifers to contamination from human activities and highlight the need for continued monitoring, adaptive management, and collaborative land-use planning. These efforts are critical to safeguarding water quality and public health in the Great Miami River Watershed.

Introduction

The Miami Conservancy District (MCD) monitors groundwater quality at select locations within the Great Miami River Watershed through a network of monitoring wells. This program aims to improve understanding of how human activities affect groundwater resources. In 2025, MCD staff collected samples from 14 monitoring wells to assess water quality in the buried valley aquifer (see Figure 1). Many of the wells are situated in areas where surrounding land uses could potentially introduce contaminants into the aquifer. All monitoring wells are installed in unconfined sand and gravel aquifers with permeable soil at or near the ground surface. Nine of the wells are situated within 400 feet of a river or lake. A comparison of static water level measurements with nearby streamgage data suggests hydraulic interactions occur between groundwater and surface water at some of the well locations. Eight of the wells are screened at shallow (< 50 feet) depths. Table 1 summarizes depths and screened intervals for all the monitoring wells in this survey and the period of record for which groundwater monitoring activities have occurred.

MCD staff collected samples twice a year during the spring and fall seasons. In 2025, samples were analyzed for:

- Escherichia coli (E. coli)
- major ions
- metals
- nutrients
- per- and polyfluoroalkyl substances (PFAS) (spring season only)

To analyze the samples, MCD contracted with Alloway Environmental Company for all parameters except PFAS. Eurofins Environmental Testing performed the PFAS analyses. Analyses of PFAS were only performed on samples collected during the spring season. The other parameters were analyzed in both sampling events.

The results of this study are compared with federal drinking water standards and human health-based screening levels. Drinking water standards are generally more stringent than other water standards, so when groundwater quality meets drinking water standards it should be suitable for other uses.

The National Primary Drinking Water Regulations are legally enforceable standards set by the USEPA (United States Environmental Protection Agency) that apply to public water systems. Primary standards set maximum contaminant levels (MCLs) that help protect public health by limiting the contaminant concentrations in drinking water.

National Secondary Drinking Water Standards are advisable guidelines addressing secondary maximum contaminant levels (SMCLs) that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. The USEPA recommends, but does not require, that public water systems incorporate secondary standards.

The USEPA Office of Water also publishes non enforceable Health-Based Screening Levels (HBSLs) for some constituents which may pose potential human-health concerns but do not yet have an enforceable standard. HBSLs are used as a supplement for evaluating contaminants in drinking water in a human-health context. For this study, all MCLs and HBSLs are referred to as human-health benchmarks and used for interpreting analytical results.

While some of the monitoring wells are near public water supply wells, it should be noted that none of the monitoring wells in MCD's groundwater monitoring network are used as a source of drinking water. The wells are only used for monitoring purposes.

Sampling Methods

Prior to collecting a sample, water is purged from each well using micropurge techniques (Puls and Barcelona, 1996). Dedicated bladder pumps are installed in each monitoring well to facilitate sample collection and minimize the potential for cross contamination of sampling equipment. The bladder pumps are activated using compressed nitrogen gas and the purge water was discharged to the ground and away from the well opening.

In 2025, samples were collected twice between May 28 and June 21 (spring) and September 17 and October 18 (fall).

Flow rates for the bladder pumps were not allowed to exceed 1L/min. The flow rate was checked periodically during the micropurge process using a 1-liter plastic bottle. In addition, the drawdown within the well was also measured periodically with an electronic water level tape. In general, little to no drawdown was observed and the wells were typically purged within 60 minutes prior to sampling.

MCD measured general water quality parameters in the field during the micropurge process to ensure fresh water was entering the well prior to sample collection. The parameters dissolved oxygen, pH, oxygen reduction potential, specific conductance,

and temperature were monitored continuously using a flow cell connected to a multiparameter sonde. The sensors on the multiparameter sonde were calibrated at the beginning of each sampling event and then checked at the start of each week with YSI Confidence Solution to determine if calibration was needed. Field measurements were recorded at 5-minute intervals on field sampling logs. When the parameters stabilized (i.e. consistent values compared to prior measurements), the well was considered ready to be sampled. The final dissolved oxygen, pH, oxidation reduction potential, specific conductance, and temperature results are included in the Appendix of this report.

Samples were collected from each well by replacing the flow cell and associated tubing with dedicated sample tubing. Teflon-lined tubing and fittings were used to direct the flow of water into the sample container. The samples were collected in laboratory supplied sample containers prepared, as necessary, with the appropriate preservatives. The sample containers were placed directly under the flow from the well to collect the sample. Upon collection, the containers were sealed and placed in a cooler with ice. Sample coolers were either picked up by a courier or shipped directly to the laboratory.

Duplicate samples were collected from one monitoring well during each sampling event to evaluate laboratory precision. Field blanks were also collected to assess potential contamination from field conditions during sampling.

Results

All analytical results are presented in the Appendix of this report.

Table 2 provides a summary of significant detections of analytical parameters.

Groundwater Levels

Continuous "depth to groundwater" readings are recorded with pressure transducer sensors at all 14 of the monitoring wells. Monitoring well PRE10007 became equipped with a sensor in November of 2024. Most of the wells respond quickly to precipitation events because they are shallow wells installed in sand and gravel aquifers with permeable soils near rivers and streams. Groundwater levels measured during the spring sampling event were higher than those measured during the fall (see Figure 2) reflecting winter and spring seasonal recharge. This is typical for shallow wells in the buried valley aquifer system. Figure 2 shows six significant pulses of groundwater recharge in the monitoring wells between January 1 and May 8 resulting from precipitation events. Peak groundwater levels occurred in early April because of multiple days with significant precipitation between March 30 and April 6.

Later in the year, several large precipitation events with more than an inch of rain occurred between June 1 and August 13. These precipitation events did not cause groundwater levels in the monitoring wells to rise as much as they did in April and May. The reason is most likely due to higher rates of evapotranspiration in summer and early fall, in comparison to spring. High rates of evapotranspiration prevent precipitation from infiltrating through the unsaturated zone and recharging the aquifer. It is apparent (figure 2) that most 2025 aquifer recharge took place prior to the end of May and the spring sampling event while little or no aquifer recharge occurred during the fall event except for the end of September when a large precipitation event occurred.

Groundwater Composition

Analysis of major ions (cations and anions) in groundwater samples show the dominant cation is calcium with significant quantities of magnesium and sodium also present. The average calcium concentration of groundwater samples was 94 mg/L. The dominant anion was bicarbonate with lesser amounts of chloride and sulfate. Bicarbonate content was estimated using alkalinity and pH measurements for each sample. The average bicarbonate concentration in groundwater samples was 348 mg/L. A piper diagram of major cations and anions shows the groundwater has a calcium-magnesium-bicarbonate composition (see Figure 3). Calcium-magnesium-bicarbonate groundwater tends to be present in areas where carbonate rocks comprise a significant amount of the aquifer matrix.

Aquifer Redox Conditions

The redox (reduction-oxidation) state of water exerts control on the water chemistry and what kinds of dissolved constituents are likely to be present. Redox processes can mobilize or immobilize naturally occurring toxic metals in aquifer systems, contribute to degradation or preservation of anthropogenic contaminants or generate undesirable byproducts such as manganese, iron, and hydrogen sulfide gas (U.S. Geological Survey, 2009). For this report, the framework of McMahon and Chapelle (2008) was used for assessing redox conditions in the buried valley aquifer at each monitoring well location. The redox framework is based on the dissolved concentrations of five water-quality parameters (dissolved oxygen (O_2), nitrate – N (NO_3^-), manganese (Mn^{2+}), iron (Fe^{2+}), and sulfate (SO_4^{2-})) all of which were measured in the groundwater samples collected for this report. Table 3 shows the redox framework (Chapelle and others, 2009). Analysis of groundwater samples and application of the redox framework allowed MCD to determine the general redox category for groundwater sampled in each of the 13 monitoring wells. The results are summarized in table 4.

Figure 4 depicts a conceptualized sequence of redox zones in an aquifer system as they become progressively more reduced with depth (Ohio EPA, 2014). These redox zones may or may not all be present in each location. In general, oxic waters have dissolved oxygen and no iron or manganese. Suboxic waters have little or no dissolved oxygen but may have nitrate - N or manganese. Anoxic groundwaters do not have any dissolved oxygen and may have dissolved iron, hydrogen sulfide gas, and even methane. Arsenic could be present in anoxic groundwaters but is generally absent in oxic groundwaters. The reason is that arsenic tends to bind with the iron hydroxides and moves with them in groundwater when the iron hydroxides are dissolved (Thomas, 2007).

The redox category remained constant for 10 of the 14 monitoring wells between spring and fall sampling events. Redox conditions changed in monitoring wells HAM10010, MON00022, PRE10007, and SHE00089. Monitoring wells HAM10010 and PRE10007 are installed in unique aquifer conditions. HAM10010 is a shallow well on a floodplain exposed to periodic inundation from the nearby Great Miami River. Previous studies conducted at the site show clear evidence of stage-driven mixing of water in the river and the aquifer in which monitoring well HAM10010 is installed (Wallace and Soltanian, 2021a and 2021b). Flood events may result in mixing of groundwater and surface water which could change redox conditions in shallow zones of the aquifer in which the well is installed. The redox category at this well changed from oxic conditions to mixed. Monitoring well PRE10007 is in proximity to two public water supply wells. Pumping of the supply wells may result in mixing of anoxic and oxic groundwaters. MCD staff have measured changes in oxidation reduction potential in the well during times when one of the pumping wells has turned on. Redox conditions measured in PRE10007 changed from mixed to anoxic.

Monitoring wells MON00022 and SHE00089 are shallow wells installed in unconfined aquifers. Redox conditions in MON00022 changed from anoxic to oxic while SHE00089 changed from mixed to suboxic. Changes in redox conditions in these wells could be a result of several factors including aquifer recharge, fluctuating groundwater levels, and mixing of surface and groundwaters.

Exceedances of Primary Drinking Water Standards and Human-Health Benchmarks

Groundwater samples collected from monitoring wells CLA10011, DAR00006, MIA00205, MON10016, WAR10003, and WAR10004 met all applicable human-health benchmarks including MCLs and HBSLs for both sampling events (see Table 5).

Concentrations of one or more parameters exceeded human-health benchmarks in groundwater samples collected from monitoring wells BUT10014, BUT10016, BUT10017, CLA10018, HAM10010, MON00022, PRE10007, and SHE00089. Table 5 provides a summary of all parameters exceeding human-health benchmarks. Parameters exceeding human-health benchmarks in at least one groundwater sample included E. coli, iron, manganese, nitrate-N, perfluorooctanoic acid (PFOA), and perfluorooctanesulfonic acid (PFOS).

E. coli was detected at 1 MPN/100mL in the fall groundwater sample collected from monitoring well BUT10016. The MCL for E. coli is 0 MPN/100 mL. E. coli was not detected in the spring groundwater sample collected from BUT10016.

Iron concentrations measured in spring samples collected from MON00022 and PRE10007 exceeded the Health-Based Screening Level (HBSL) of 4,000 micrograms per liter (µg/L). However, concentrations of iron in the fall samples from both wells fell below the HBSL.

Manganese has an HBSL of 300 µg/L. Concentrations of Manganese exceeded this level in samples collected from monitoring wells BUT10016, BUT10017, and SHE00089 for the spring sampling event. Manganese concentrations in fall samples from BUT10016 and SHE00089 also exceeded the HBSL.

The maximum contaminant level (MCL) in drinking water for nitrate – nitrogen (nitrate-N) is 10 milligrams per liter (mg/L). The nitrate-N concentration measured in the sample collected from monitoring well CLA10018 exceeded this standard in the spring sampling event but fell below the MCL for the fall event.

The maximum contaminant level for PFOA and PFOS is 4 nanograms per liter (ng/L). Concentrations of PFOA exceeded the MCL in samples collected from BUT10014, BUT10017, and HAM10010 in the fall event. Concentrations of PFOS exceeded the MCL in samples collected from BUT10014 and BUT10017 in the fall event.

Exceedances of Secondary Drinking Water Standards

Groundwater samples collected from monitoring wells CLA10018 and WAR10004 met all secondary drinking water standards (SMCLs) for both sampling events (see Table 6). Table 6 provides a summary of all parameters exceeding SMCLs. Parameters exceeding applicable SMCLs in at least one groundwater sample included iron, manganese, and total dissolved solids (TDS).

Anthropogenic Contaminants

Chemical parameters detected in groundwater samples that likely reflect anthropogenic sources include chloride, nitrate-N, sodium, and the PFAS compounds NMeFOSAA, PFBS, PFBA, PFHpA, PFHxS, PFHxA, PFNA, PFOS, PFOA, and PFPeA. Chloride and sodium are present in groundwater naturally, but human activities can elevate their concentration significantly above natural levels. Likewise, nitrogen primarily in the form of nitrate can be naturally present in groundwater, but anthropogenic sources of nitrogen can elevate nitrate-N concentrations above levels that would be present in the absence of human activities. PFAS are manufactured compounds not known to be present in groundwater unless anthropogenic sources are present. A summary of parameters detected in at least one groundwater sample and thought to reflect anthropogenic sources of contaminants follows.

Chloride and Sodium

Chloride has an SMCL of 250 mg/L in drinking water. There is a drinking water advisory (DWA) for sodium of 20 mg/L for individuals on a 500 milligram per day (mg/d), low-sodium diet (U.S. Environmental Protection Agency, 2018). Ohio EPA considers chloride concentrations above 20 mg/L in Ohio groundwater to be an indication of anthropogenic impact (Ohio EPA, 2023). Kunz and Sroka (2004) reported mean background concentrations of chloride ranging from 13 to 23 mg/L in shallow unconsolidated aquifers in Champaign, Clark, and Pickaway counties in Ohio.

For the purposes of determining background concentrations of sodium and chloride in the BVAS, MCD analyzed Ohio EPA ambient groundwater quality data. Chloride and sodium data were examined for seven Ohio EPA ambient monitoring wells installed in the BVAS or in alluvial sand and gravel aquifers within the Great Miami River Watershed. These wells were selected because they were installed in rural areas where impacts from road salt applications as well as other anthropogenic sources are thought to be minimal. The wells were also selected because chloride and sodium data collected

from these wells did not show evidence of increasing trends. Chloride and sodium data for these ambient monitoring wells was collected between the years 1981 and 2020. Analysis of data from 164 groundwater samples showed median chloride and sodium concentrations of 22.2 and 13.0 mg/L respectively. The upper quartile sodium and chloride concentrations were 28.0 and 16.0 mg/L. MCD elected to use the upper quartile concentrations as a conservative threshold for assessing anthropogenic impact.

- Chloride concentrations measured in groundwater samples from monitoring wells BUT10014, HAM10010, MON10016, PRE10007, WAR10003, and WAR10004 exceeded 28 mg/L in at least one sampling event in 2025 and likely reflect anthropogenic sources.
- Sodium concentrations in groundwater samples from monitoring wells BUT10014, HAM10010, MON10016, PRE10007, WAR10003, and WAR10004 exceeded 16 mg/L in one or both sampling events also reflecting anthropogenic sources.

Anthropogenic sources of chloride and sodium include road salt application for deicing as well as private and municipal wastewater from homes with water softeners.

Nitrogen as Nitrate

Nitrogen in groundwater exists in inorganic and organic forms. Inorganic nitrogen is present as ammonia, nitrite-N, and nitrate-N. Of these three inorganic forms, nitrate-N is the dominant species. According to Madison and Brunett (1985), nitrate-N concentrations above 3.0 mg/L in groundwater are often indicative of anthropogenic sources. Nitrate-N concentrations measured in groundwater samples during the spring and fall sampling events for monitoring wells BUT10017, CLA10018, and MIA00205 exceeded the 3.0 mg/L threshold.

Common sources of nitrate-N in groundwater include fertilizers, domestic or municipal wastewater, and animal waste or manure applied as fertilizer. Monitoring wells CLA10018 and MIA00205 are particularly vulnerable to sources of nitrate. Both wells are located within or adjacent to agricultural fields used for corn and soybean production and screened at shallow depths. Wells BUT10017 and CLA10018 had oxic groundwater conditions which tend to allow nitrate-N to remain stable (McMahon and Chapelle, 2008). In contrast, groundwater conditions at monitoring well MIA00205 were anoxic yet nitrate-N was still present in the samples.

Analysis of nitrogen and oxygen isotopes measured in groundwater samples collected from BUT10017 and CLA10018 in 2017 and 2018 suggested an inorganic fertilizer source for the nitrate present in those wells (Bedaso and Ekberg, 2019).

Per- and polyfluoroalkyl substances (PFAS)

PFAS are a group of manufactured chemicals used in industry and consumer products since the 1940s because of their properties that resist heat, grease, and water. There are thousands of different PFAS compounds, some of which have been more widely used and studied than others (USEPA, 2023).

Laboratory analysis detected one or more PFAS compounds in groundwater samples collected from monitoring wells BUT10014, BUT10017, DAR00006, HAM10010, MIA00205, MON00022, MON10016, PRE10007, WAR10003, and WAR10004. PFAS compounds detected in one or more groundwater samples include NMeFOSAA, PFBS, PFBA, PFHpA, PFHxS, PFHxA, PFNA, PFOS, PFOA, and PFPeA. The most frequently detected PFAS compounds were PFBS, PFBA, and PFOS. Each of these compounds was detected in seven groundwater samples.

The highest concentrations of PFAS compounds were detected in the groundwater samples from monitoring wells BUT10014, BUT10017, and HAM10010. BUT10014 is located near an industrial park and airport where it is likely that PFAS have been stored and used in the past. HAM10010 is located within the University of Cincinnati's Theis Environmental Monitoring and Modeling Site (TEMMS). As mentioned previously, studies conducted at the site show clear evidence of stage-driven mixing of water in the river and the aquifer in which monitoring well HAM10010 is installed. Furthermore, previous sampling of the Great Miami River by MCD in 2023 detected the PFAS compounds PFBA, PFBS, PFPeA, PFHxA, PFHxS, PFOA, and PFOS in river samples at the site (MCD, 2023). This suggests the river could be a source for the PFAS detected in HAM10010.

Naturally Occurring Contaminants

Nuisance Contaminants

Hardness, iron, manganese, and total dissolved solids are "nuisance" contaminants. These contaminants are present naturally in groundwater from the buried valley aquifer system. Their presence does not typically pose a health threat. Nevertheless, they can have aesthetic impacts that cause water to appear cloudy or colored. They can also adversely impact plumbing fixtures, stain laundry, and cause taste and odor issues. At high enough concentrations manganese may pose health concerns. In 2004, U.S. EPA issued a lifetime health advisory level of 300 µg/L for manganese in drinking water. This benchmark indicates a safe level of exposure over the course of a lifetime.

Hardness is a measure of the amount of calcium and magnesium dissolved in a water sample. USGS classifies hardness values above 180 mg/L the water as very hard (USGS, 2018). Hardness was above 180 mg/L in all groundwater samples collected in 2025.

There is no SMCL for water hardness.

The SMCL for Iron is 300 µg/L. Iron concentrations measured in samples collected from monitoring wells BUT10016, CLA10011, PRE10007, and WAR10003 exceeded this standard in both sampling events.

The SMCL for manganese is 50 µg/L. Manganese concentrations in groundwater samples collected from monitoring wells BUT10016, CLA10011, MIA00205, MON10016, SHE00089 and WAR10003 exceeded this standard during both sampling events. Manganese also has a HBSL (lifetime advisory level) of 300 µg/L. The spring and fall groundwater samples collected from wells BUT10016 and SHE00089 exceeded this standard while the fall sample collected from BUT10017 exceeded the standard.

Total dissolved solids (TDS) are comprised of inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates). TDS is the sum of cations and anions in a water sample. The SMCL for TDS is 500 mg/L. Groundwater samples collected from wells BUT10014, HAM10010, MON00022 and WAR10003 exceeded this standard for at least one sampling event.

Contaminant Trends

Groundwater quality data collected in 2025, and in previous years, was analyzed for trends in contaminant concentrations. MCD selected the chemical parameters chloride, sodium, and nitrate-N as parameters indicative of anthropogenic sources. The parameters iron and manganese were selected to examine trends in naturally occurring contaminant concentrations.

Chloride and Sodium

Chloride concentrations measured in samples collected from monitoring wells BUT10014, HAM10010, MON10016, PRE10007, WAR10003, and WAR10004 are consistently higher than 30 mg/L and consistently above the concentrations measured in samples from the other monitoring wells (see Figure 5). Chloride concentrations in monitoring well WAR10003 seem to be trending upward, while recent concentrations in monitoring wells BUT10014 and MON10016 have declined. There does not appear to be any strong upward or downward trends with chloride concentrations measured in groundwater samples collected from other monitoring wells.

Like chloride, sodium concentrations measured in the six wells (BUT10014, HAM10010, MON10016, PRE10007, WAR10003, and WAR10004) are consistently higher than concentrations measured at other monitoring wells (see Figure 6). As with chloride, sodium concentration in monitoring well WAR10003 seem to be increasing while recent concentrations of sodium in monitoring wells BUT10014 and MON10016 have declined. There does not appear to be any strong upward or downward trends with sodium concentration measured on other monitoring wells.

Seasonal fluctuations in chloride and sodium are often more pronounced in wells with the highest concentrations of those parameters. These fluctuations may reflect infiltration of saline water from snow melt and rainfall events after seasonal applications of road salt.

Nitrogen as Nitrate

Nitrate-N concentrations measured at monitoring wells BUT10017, CLA10018 and MIA00205 consistently exceed 3 mg/L and likely reflect anthropogenic sources of nitrate-N to the aquifer screened by those wells (see Figure 7). Concentrations of nitrate-N in groundwater samples from all three monitoring wells fluctuate from year to year and have exceeded the MCL of 10mg/L in samples collected from wells BUT10017 and CLA10018 on occasion. Nitrate-N concentrations in BUT10017 seem to be trending downward in recent years.

Iron

There are large fluctuations in iron concentrations measured in groundwater samples collected from monitoring wells HAM10010 and PRE10007. The presence of iron in groundwater is often controlled by redox conditions. The large fluctuations in iron concentrations could be an indication of oxic and anoxic groundwater mixing in the vicinity of rivers and wellfields. Groundwater samples showed fluctuating groundwater redox conditions in both wells in 2025. As discussed previously, monitoring well HAM10010 is in a floodplain area where mixing of groundwater and surface water is known to occur. Likewise, PRE10007 is in a municipal well field where groundwaters under differing redox conditions may be mixed due to production well pumping. MCD staff noted fluctuating dissolved oxygen levels in the monitoring well during previous sampling events as nearby production wells turned on and off. This suggests fluctuating redox conditions are present at the well. There does not appear to be any upward or downward trend in iron concentrations in the other monitoring wells.

Manganese

Manganese concentrations measured in monitoring wells BUT10016, CLA10011, MIA00205, MON10016, SHE00089, and WAR10003 consistently exceed the SMCL of 50 µg/L. Concentrations of manganese in BUT10016 and SHE00089 are consistently near or above the HBSL of 300 µg/L. No clear trends in manganese concentrations are present. However, the fall 2025 manganese concentration measure in well BUT10016 of 740 µg/L appears to be an outlier and a substantial increase above previous results for the well. The elevated manganese concentration may have resulted from well redevelopment activities that occurred two weeks prior to sample collection.

Conclusions

The 2025 groundwater monitoring program reinforces several key themes regarding water quality in the buried valley aquifer system. Contaminants originating from anthropogenic sources, including nitrate-N, sodium, chloride, and PFAS, are frequently present in shallow aquifer settings, particularly near industrial, agricultural, or developed areas. Naturally occurring “nuisance” constituents, such as iron, manganese, and total dissolved solids, consistently exceed secondary standards and occasionally health-based benchmarks, impacting aesthetics and potentially requiring treatment.

Redox conditions and seasonal groundwater fluctuations influence the concentrations of certain constituents, emphasizing the dynamic nature of aquifer chemistry. Interconnections between the Great Miami River and the underlying aquifer facilitate the transfer of surface water contaminants to groundwater.

While the monitoring network does not fully characterize the entire aquifer system, the data provide critical insights into contaminants of concern, trends, and potential sources. The study underscores the importance of vigilant monitoring, adaptive management, and coordinated efforts with regional stakeholders to protect groundwater resources and public health. MCD remains committed to using scientific evidence to guide interventions and ensure the long-term resilience of the watershed’s groundwater system.

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Tables

***Table 1** – Construction details for groundwater monitoring wells.*

Monitoring Well	Casing Diameter (in)	Well Depth (ft)	Screened Interval (ft)	Aquifer Screened	Distance to River or Lake (ft)	Start of Sampling Record
BUT10014	2	40	35 - 40	Sand and Gravel	120	Spring 2014
BUT10016	2	65	60 - 65	Sand and Gravel	120	Spring 2014
BUT10017	2	39	34 - 39	Sand and Gravel	120	Spring 2016
CLA10011	2	60	55 - 60	Sand and Gravel	135	Spring 2016
CLA10018	2	16	11 - 16	Sand and Gravel	2,810	Spring 2014
DAR00006	2	67	57 - 67	Sand and Gravel	405	Spring 2025
HAM10010	2	30	28 - 30	Sand and Gravel	340	Spring 2023
MIA00205	2	24	19 - 24	Sand and Gravel	1,130	Spring 2015
MON00022	2	15	10 - 15	Sand and Gravel	110	Spring 2015
MON10016	2	108	88 - 108	Sand and Gravel	355	Spring 2014
PRE10007	2	60	40 - 60	Sand and Gravel	960	Spring 2016
SHE00089	2	43	38 - 43	Sand and Gravel	600	Spring 2015
WAR10003	2	67	62 - 67	Sand and Gravel	85	Spring 2016
WAR10004	2	32.5	27.5 - 32.5	Sand and Gravel	90	Spring 2015

***Table 2** – Summary of significant detections of analytical parameters.*

Spring 2025		**Benchmark**		**Sample Sites**						
Parameter	**Units**	**Type**	**Value**	**BUT10014**	**BUT10016**	**BUT10017**	**CLA10011**	**CLA10018**	**DAR00006**	**HAM10010**
Chloride	mg/L	SMCL	250	39						44
Nitrogen, Nitrate-N	mg/L	MCL	10			3.36		**10.7**		
Sodium	mg/L	—	—	28						26
NMeFOSAA	ng/L	—	—						2.5	
PFBS	ng/L	MCL	Hazard Index	2		7.4				3.5
PFBA	ng/L	—	—	1.5J		2.5J				3.7
PFHpA	ng/L	—	—			1.2J				0.91J
PFHxS	ng/L	MCL	Hazard Index	2.5		1J				3
PFHxA	ng/L	—	—	0.7J		3.7				1.3J
PFNA	ng/L	MCL	Hazard Index	2.6						0.4J
PFOS	ng/L	MCL	4	**7.7**		**10I**			0.4J	2.4I
PFOA	ng/L	MCL	4	**8.8**		**11**				**4.8**
PFPeA	ng/L	—	—	0.47J		4.2				1.4J
Iron	µg/L	HBSL, SMCL	4000, 300		**1,700**	**1,600**	**3,000**		**1,900**	
Manganese	µg/L	HBSL, SMCL	300, 50		**460**	**450**	**60**			
Total Dissolved Solids	mg/L	SMCL	500	**502**						**574**
Total Hardness	mg/L	—	—	349	319	309	393	347	382	440

Table 2 cont. *– Summary of significant detections of analytical parameters.*

Spring 2025		Benchmark		Sample Sites						
Parameter	**Units**	**Type**	**Value**	**MIA00205**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**	**WAR10003**	**WAR10004**
Chloride	mg/L	SMCL	250			58	49		130	38
Nitrogen, Nitrate-Nitrite	mg/L	MCL	10	3.35						3.15
Sodium	mg/L	—	—			36	27		57	24
NMeFOSAA	ng/L	—	—			2				
PFBS	ng/L	MCL	Hazard Index		0.85J	2	0.62J			0.77J
PFBA	ng/L	—	—		2.2J	4	1.4J		1.8J	
PFHpA	ng/L	—	—							
PFHxS	ng/L	MCL	Hazard Index			0.89J				0.54J
PFHxA	ng/L	—	—							0.54J
PFNA	ng/L	MCL	Hazard Index							
PFOS	ng/L	MCL	4		0.63J	0.4J				0.72J
PFOA	ng/L	MCL	4		0.82J					0.88J
PFPeA	ng/L	—	—				0.52J			
Iron	µg/L	HBSL, SMCL	4000, 300		**71,000**		**6,200**		**2,200**	
Manganese	µg/L	HBSL, SMCL	300, 50	**64**		**74**		**300**		
Total Dissolved Solids	mg/L	SMCL	500		**550**				**588**	
Total Hardness	mg/L	—	—	347	442	302	334	345	428	255

Numbers in bold exceed a benchmark

B – analyte detected in sample and associated blank

J – estimated value

I – value is estimated maximum possible concentration

__Table 2 cont.__ – Summary of significant detections of analytical parameters.

Fall 2025		**Benchmark**		**Sample Sites**						
Parameter	**Units**	**Type**	**Value**	**BUT10014**	**BUT10016**	**BUT10017**	**CLA10011**	**CLA10018**	**DAR00006**	**HAM10010**
Chloride	mg/L	SMCL	250	40						
Nitrogen, Nitrate-N	mg/L	MCL	10			4.75		9.58		
Sodium	mg/L	—	—	30						18
E. Coli	MPN/100mL	MCL	0		**1**					
Iron	µg/L	HBSL, SMCL	4000, 300		**1,700**		**3,100**		**2,100**	**2,500**
Manganese	µg/L	HBSL, SMCL	300, 50		**740**		**64**		**91**	**32**
Total Dissolved Solids	mg/L	SMCL	500							
Total Hardness	µg/L	—	—	354	296	335	428	326	393	377
Fall 2025		**Benchmark**		**Sample Sites**						
Parameter	**Units**	**Type**	**Value**	**MIA00205**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**	**WAR10003**	**WAR10004**
Chloride	mg/L	SMCL	250			62	34		130	39
Nitrogen, Nitrate-N	mg/L	MCL	10	3.72						
Sodium	mg/L	—	—			38	23		57	23.0
E. Coli	MPN/100mL	MCL	0							
Iron	µg/L	HBSL, SMCL	4000, 300			**370**	**1,700**		**2,200**	
Manganese	µg/L	HBSL, SMCL	300, 50	**92**		**81**		**300**	**64**	
Total Dissolved Solids	mg/L	SMCL	500		**626**				**626**	
Total Hardness	µg/L	—	—	362	533	320	346	367	436	259

Numbers in bold exceed a benchmark

B – analyte detected in sample and associated blank

J – estimated value

Table 3 *– Threshold concentrations for identifying redox processes in groundwater (modified from McMahon and Chapelle, 2008; Chapelle and others, 2009).*

[O_2, dissolved oxygen; NO_3, dissolved nitrate as nitrogen; Mn^{2+}, dissolved manganese; Fe^{2+}, dissolved iron; SO_4, dissolved sulfate; H_2S, hydrogen sulfide; Mn(IV), oxidized manganese; Fe(III), ferric iron: mg/L, milligrams per liter; —, not applicable, $\geq$, greater than or equal to; $\leq$, less than or equal to]

General redox category	Predominant redox process	Distinguishing Fe(III)–from SO_4^{2-}-reduction	Water-chemistry criteria (mg/L)					Fe^{2+}/H_2S mass ratio	Comments
			O_2	NO_3^--N	Mn^{2+}	Fe^{2+}	SO_4^{2-}		
Oxic	O_2 reduction	—	$\geq$0.5	—	< 0.5	< 0.1	—	—	—
Suboxic	—	—	< 0.5	< 0.5	< 0.5	< 0.1	—	—	(1)
Anoxic	NO_3^- reduction	—	< 0.5	$\geq$0.5	< 0.5	< 0.1	—	—	—
	Mn(IV) reduction	—	< 0.5	< 0.5	$\geq$0.5	< 0.1	—	—	—
	Fe(III)/SO_4^{2-} reduction	—	< 0.5	< 0.5	—	$\geq$0.1	$\geq$0.5	—	—
	—	Fe(III) reduction	< 0.5	< 0.5	—	$\geq$0.1	$\geq$0.5	> 10	—
	—	Mix - Fe(III)/SO_4^{2-} reduction	< 0.5	< 0.5	—	$\geq$0.1	$\geq$0.5	$\geq$0.3 and $\leq$10	—
	—	SO_4^{2-} reduction	< 0.5	< 0.5	—	$\geq$0.1	$\geq$0.5	< 0.3	—
	Methanogenesis	—	< 0.5	< 0.5	—	$\geq$0.1	< 0.5	—	—
Mixed	—	—	—	—	—	—	—	—	(2)

[1]Further definition of redox processes not feasible.

[2]Criteria for more than one redox process are met.

Table 4 *– General redox category for groundwater in each well.*

Monitoring Well	Redox Category	
	Spring 2025	Fall 2025
BUT10014	Oxic	Oxic
BUT10016	Anoxic	Anoxic
BUT10017	Oxic	Oxic
CLA10011	Anoxic	Anoxic
CLA10018	Oxic	Oxic
DAR00006	Anoxic	Anoxic
HAM10010	Oxic	Mixed
MIA00205	Anoxic	Anoxic
MON00022	Anoxic	Oxic
MON10016	Anoxic	Anoxic
PRE10007	Mixed	Anoxic
SHE00089	Mixed	Suboxic
WAR10003	Anoxic	Anoxic
WAR10004	Oxic	Oxic

Table 5 *– Summary of exceedances of human-health benchmarks.*

Monitoring Well	Spring 2025	Fall 2025
BUT10014	PFOA, PFOS	
BUT10016	Manganese	*E. coli,* Manganese
BUT10017	Manganese, PFOA, PFOS	
CLA10011		
CLA10018	Nitrate-N	
DAR00006		
HAM10010	PFOA	
MIA00205		
MON00022	Iron	
MON10016		
PRE10007	Iron	
SHE00089	Manganese	Manganese
WAR10003		
WAR10004		

[*E. coli*, Escherichia coli]

***Table 6** – Summary of exceedances of secondary maximum contaminant levels (SMCLs).*

Monitoring Well	Spring 2025	Fall 2025
BUT10014	TDS	
BUT10016	Iron, Manganese	Iron, Manganese
BUT10017	Iron, Manganese	
CLA10011	Iron, Manganese	Iron, Manganese
CLA10018		
DAR00006	Iron	Iron, Manganese
HAM10010	TDS	Iron, Manganese
MIA00205	Manganese	Manganese
MON00022	Iron, TDS	TDS
MON10016	Manganese	Iron, Manganese
PRE10007	Iron	Iron
SHE00089	Manganese	Manganese
WAR10003	Iron, TDS	Iron, Manganese, TDS
WAR10004		

[TDS, total dissolved solids]

Figures

***Figure 1** – Map showing locations of monitoring wells.*

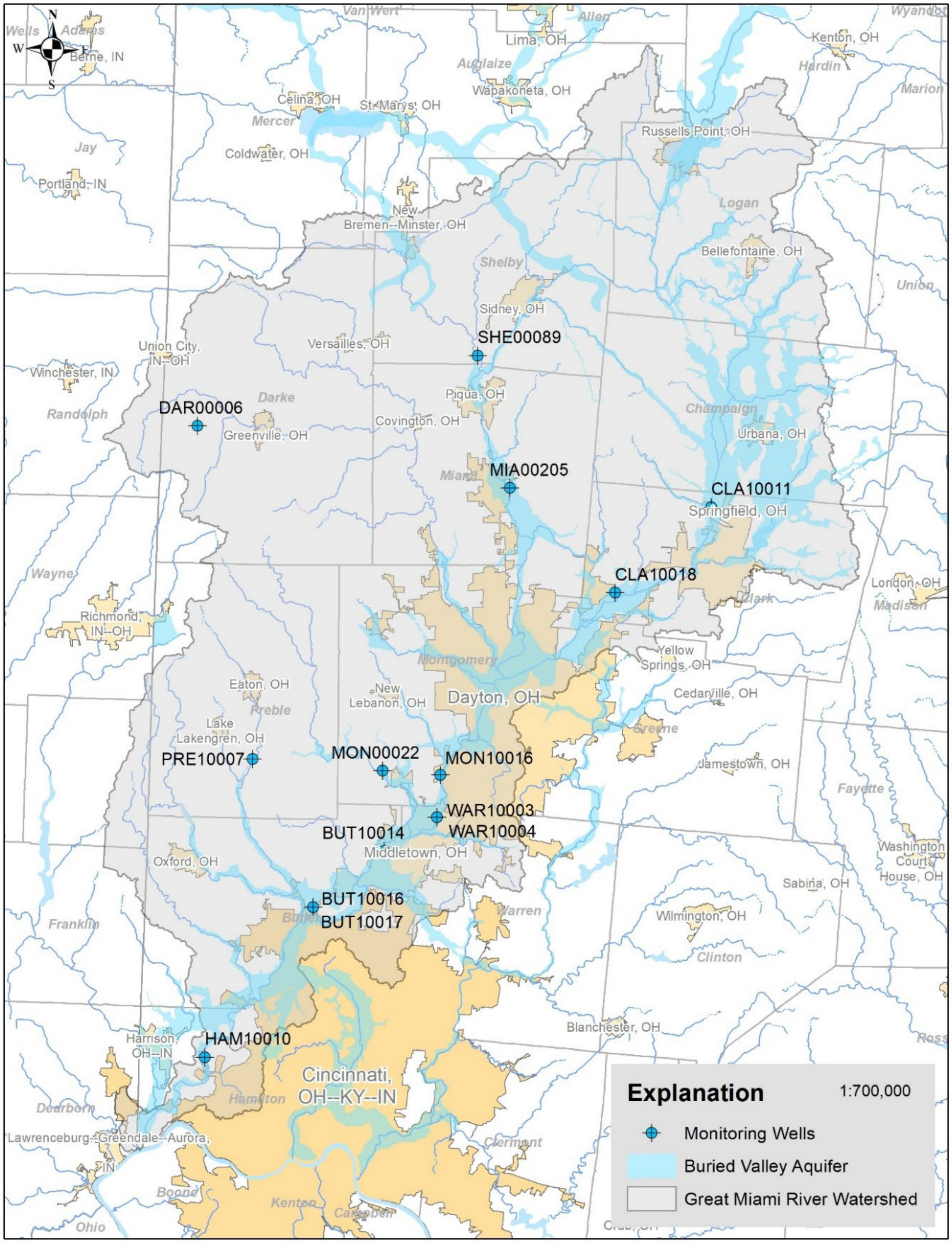


Figure 2 *– Chart showing depths to groundwater and daily precipitation measured in the Great Miami River Watershed. Gray areas show time intervals for spring and fall sampling events.*

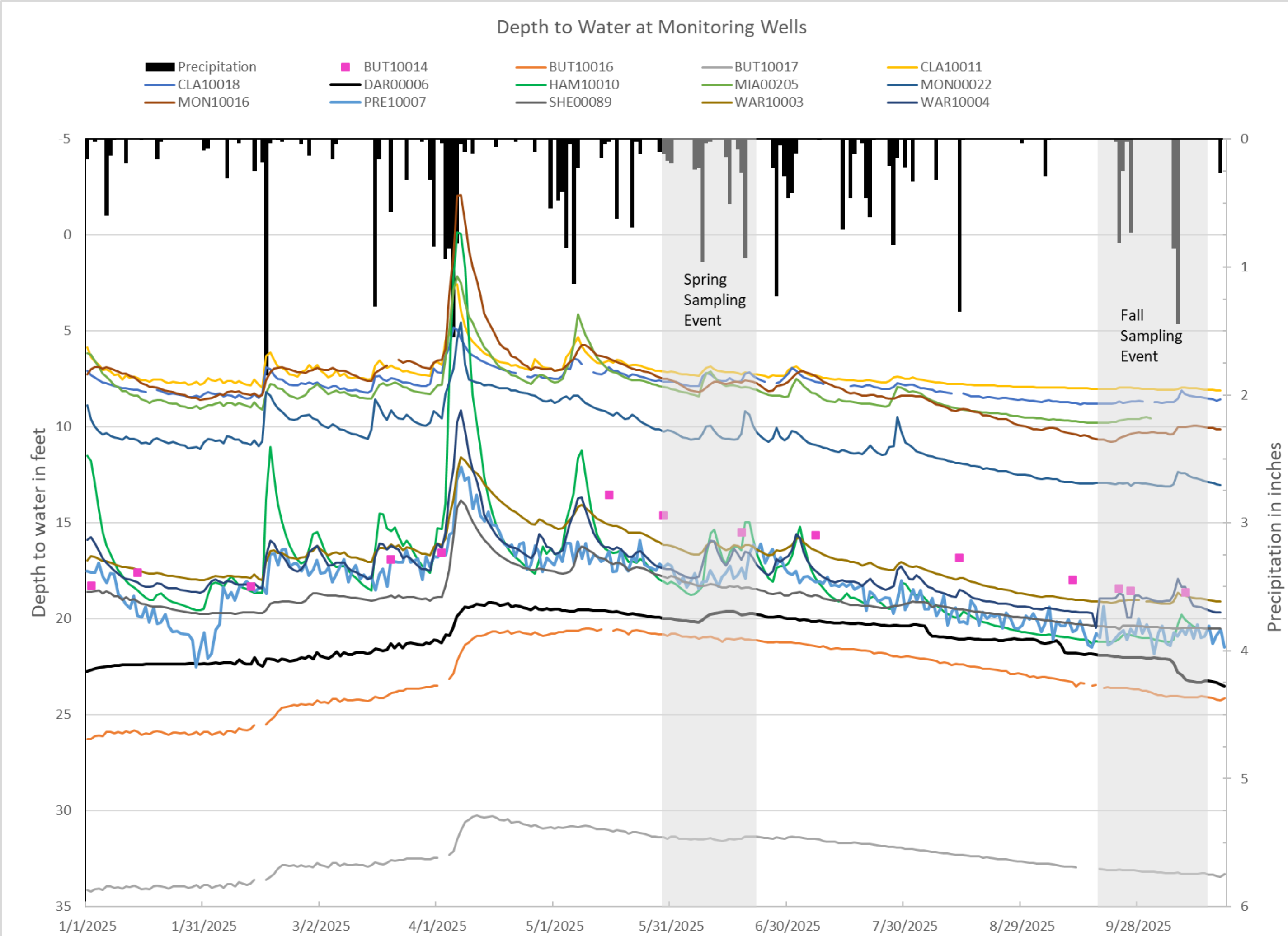


Figure 3 *– Piper diagram illustrating dominant cations, anions, and water type of groundwater samples.*

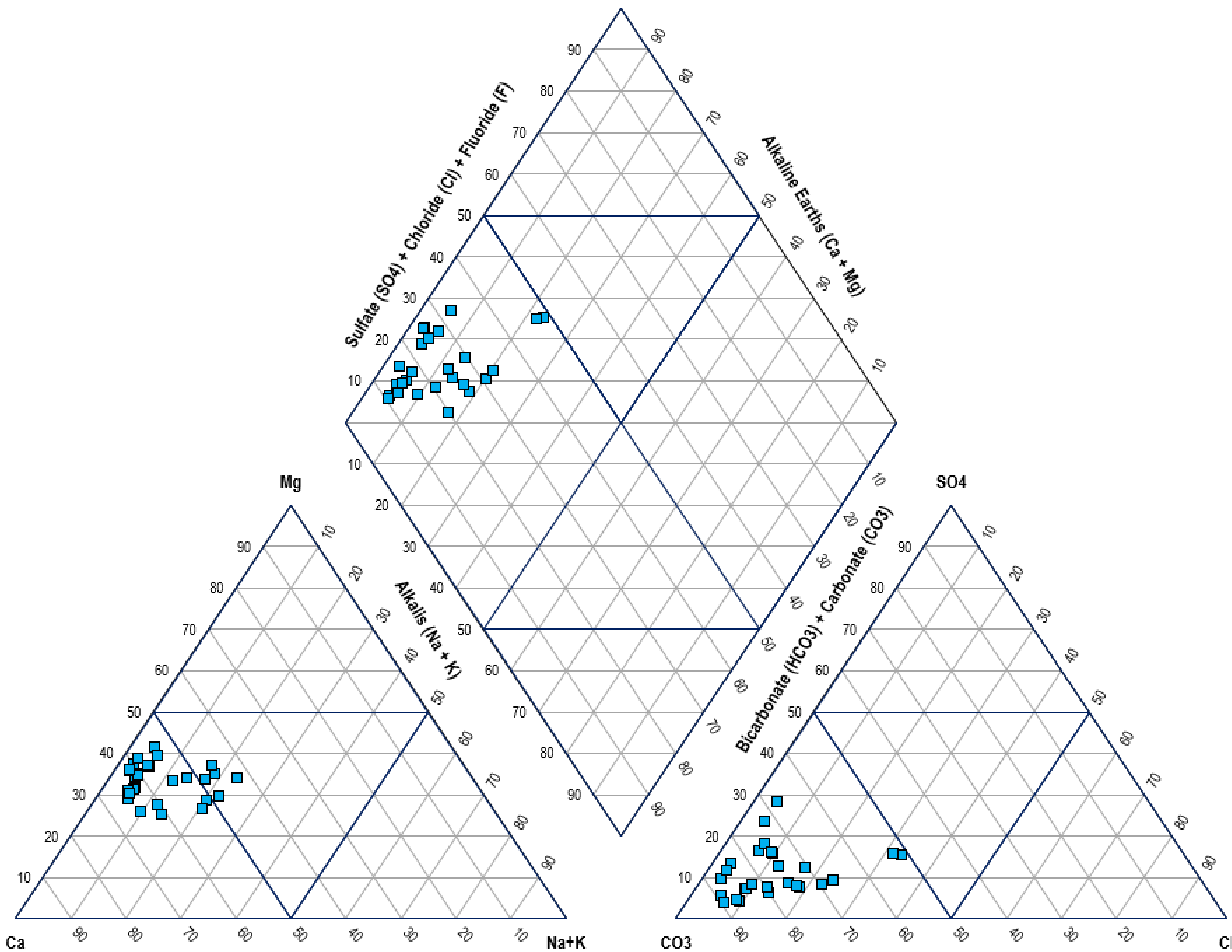


***Figure 4** – Conceptualized sequence of redox zones and parameter changes with depth (Ohio EPA, 2014).*

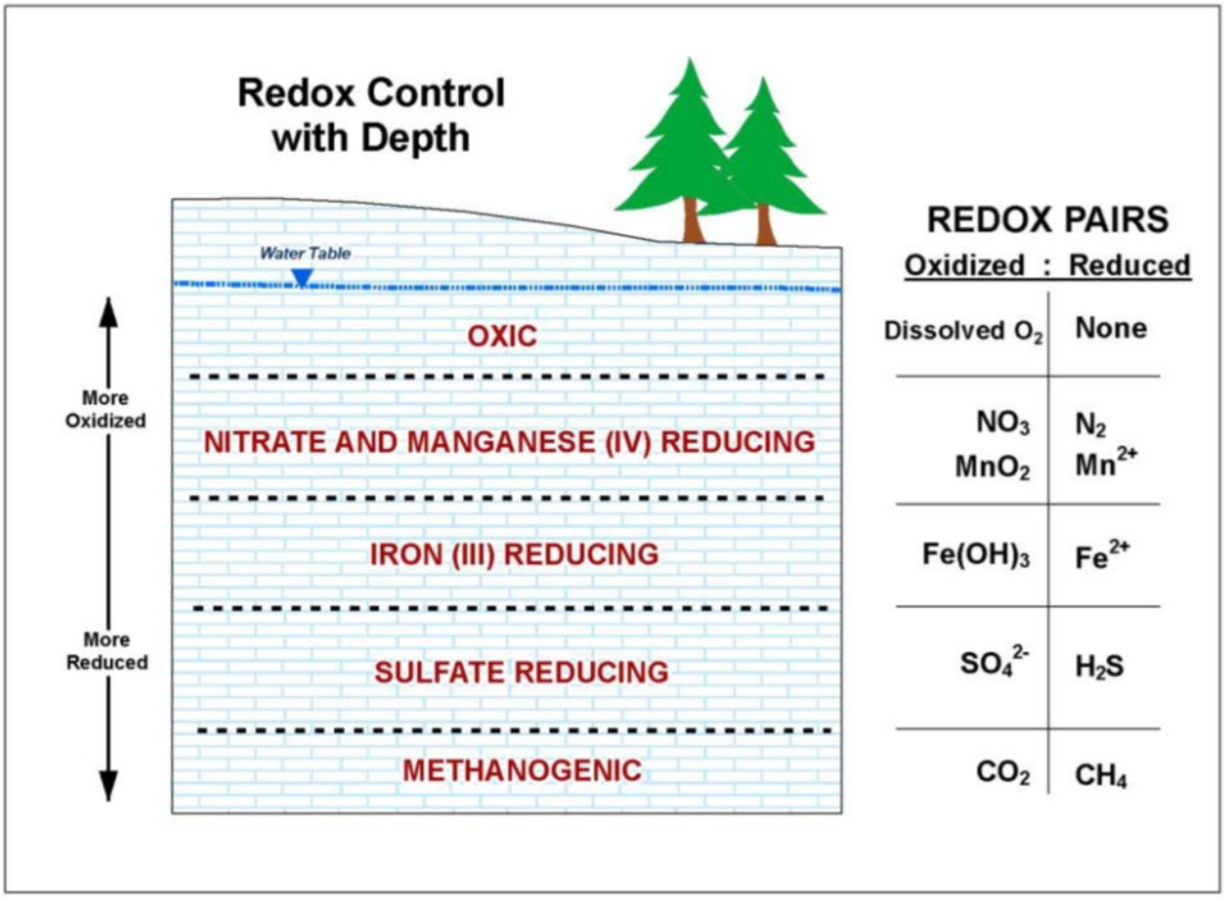


Figure 5 *– Time series of chloride concentrations in monitoring wells.*

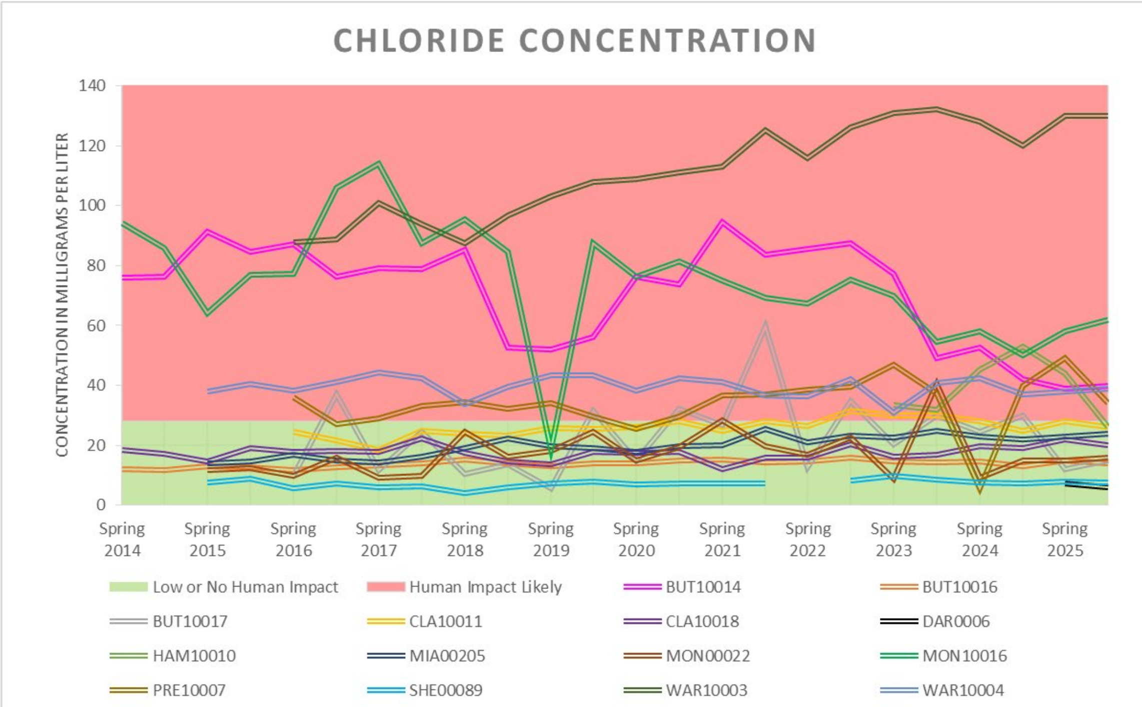


Figure 6 *– Time series of sodium concentrations in monitoring wells.*

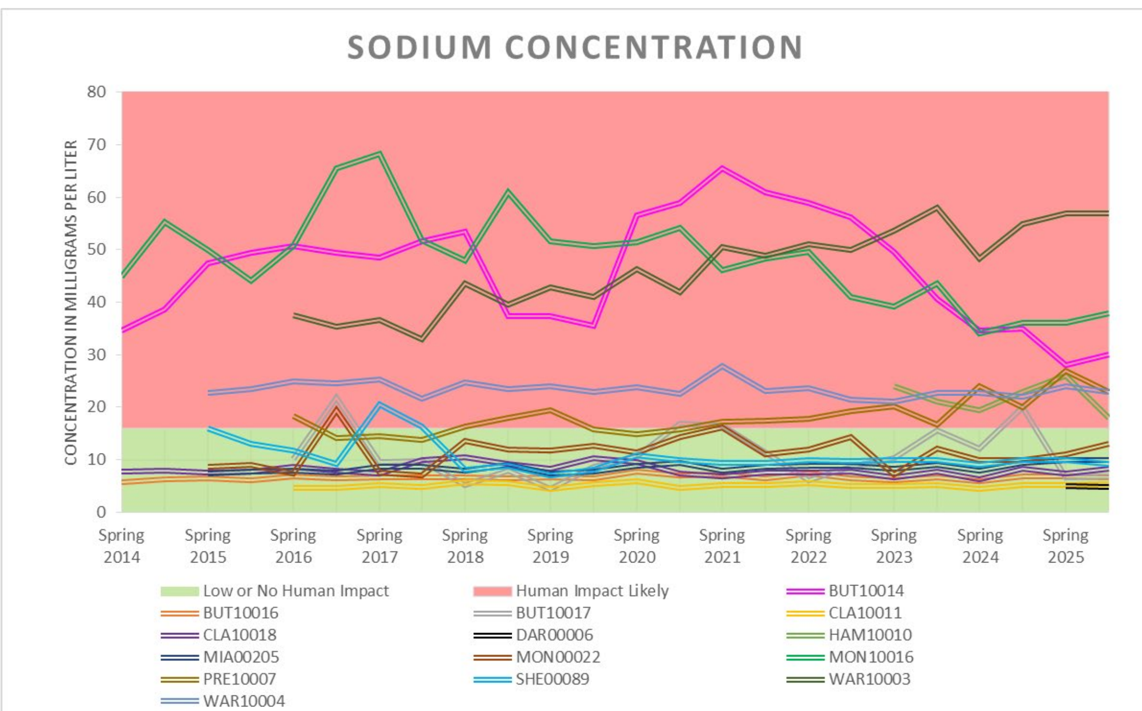


***Figure 7** – Time series of nitrate-N concentrations in monitoring wells.*

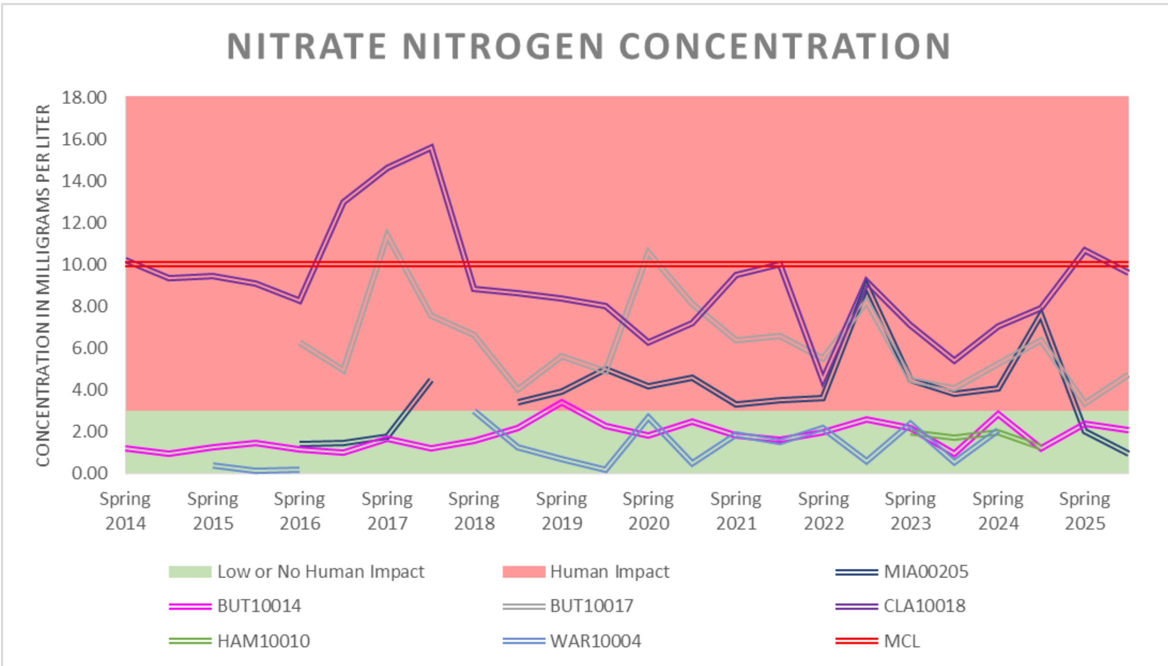


***Figure 8** – Time series of iron concentrations in monitoring wells.*

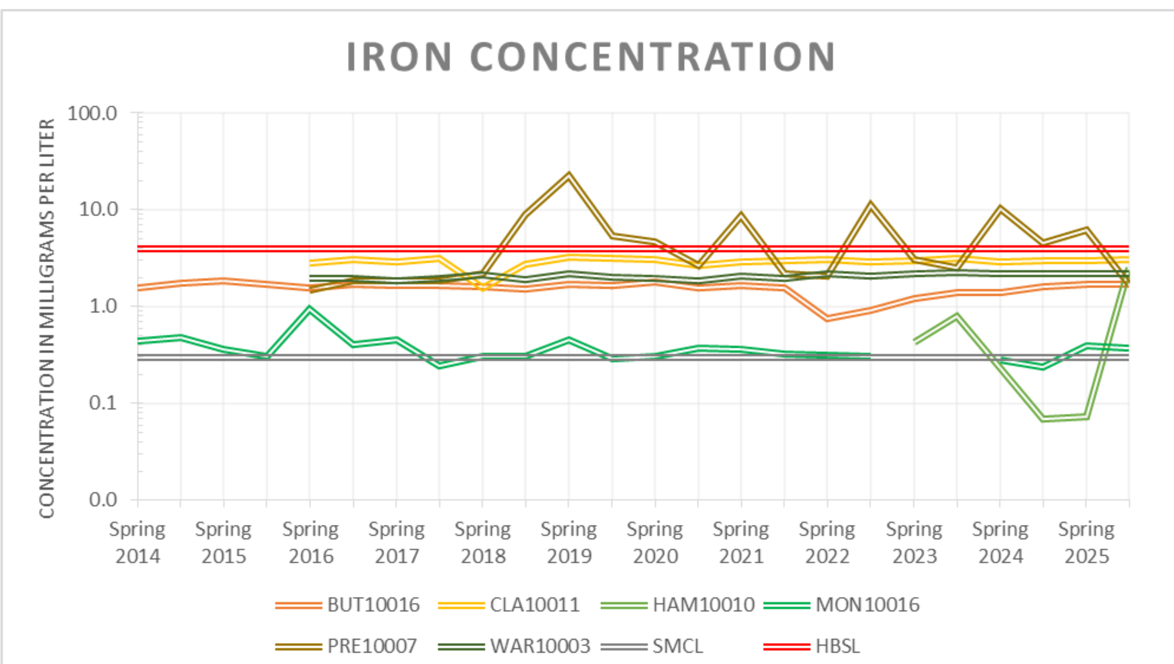
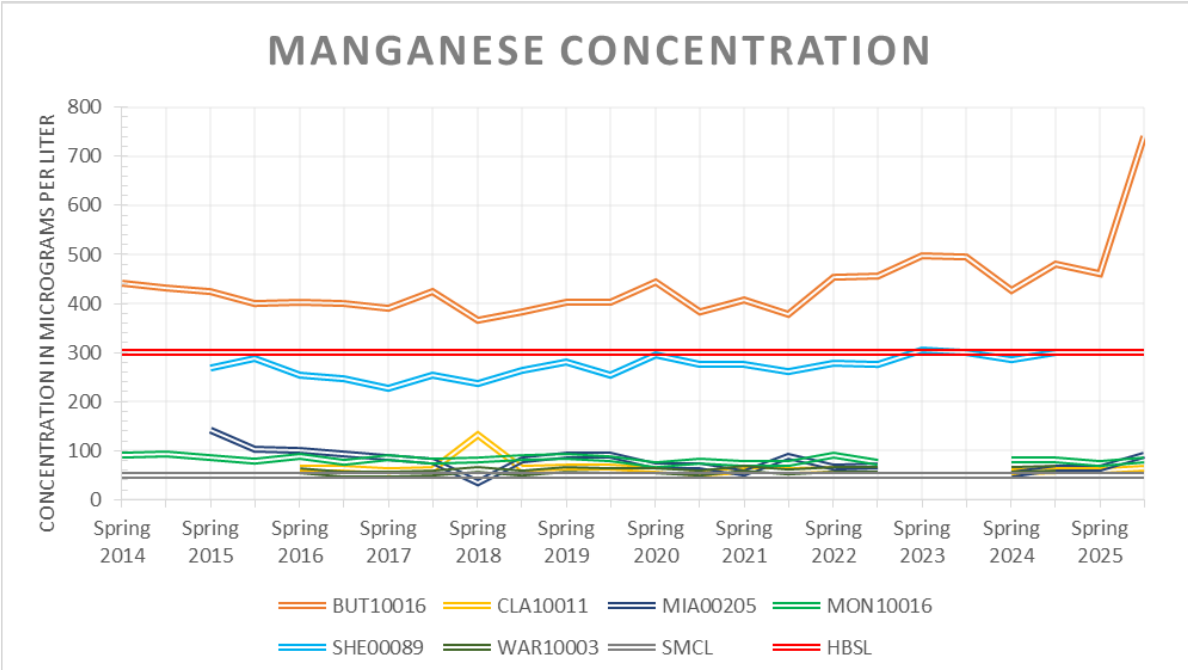


***Figure 9** – Time series of manganese concentrations in monitoring wells.*



Appendix – 2025 Groundwater Data

Spring 2025 Baseline Parameters	Units	Method	PQL	Type	Value	BUT10014	BUT10016	BUT10017	CLA10011
Dissolved Oxygen	mg/L	Field Measured	—	—	—	4.68	0.00	9.48	0.00
Oxidation Reduction Potential	mV	Field Measured	—	—	—	63.90	-158.90	62.10	-145.60
pH	S.U.	Field Measured	—	SMCL	6.5 - 8.5	7.11	7.32	7.09	7.09
Specific Conductance	mS/cm	Field Measured	—	—	—	746	747	747	744
Temperature	°C	Field Measured	—	—	—	21.7	13.1	13.1	12.3
Total Kjeldahl Nitrogen	mg/L	EPA 351.2	0.5	—	—	<0.50	<0.50	<0.50	<0.50
Hardness (Calc. as CaCO3)	mg/L	EPA 200.7 Rev. 4.4	5	—	—	349	319	309	393
Chloride	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	**39**	15	12	28
Sulfate	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	24	50	16	62
Cyanide, Total	mg/L	EPA 335.4 Rev. 1.0	0.005	MCL	0.2	<0.005	<0.005	<0.005	<0.005
Ammonia-N	mg/L	EPA 350.1 Rev. 2.0	0.05	—	—	<0.05	0.23	<0.05	0.08
Nitrate-N	mg/L	EPA 353.2 Rev. 2.0	0.05	MCL	10	2.41	<0.10	**3.36**	<0.05
Chemical Oxygen Demand	mg/L	EPA 410.4 Rev 2.0	10	—	—	<10	13	<10	17
Phenolics (as Phenol), Total	mg/L	EPA 420.4 Rev. 1.0	0.05	—	—	<0.05	<0.05	<0.05	<0.05
Aluminum, Total	ug/L	EPA 6010C	150	HBSL, SMCL	70, 50	<150	<150	<150	<150
Arsenic, Total	ug/L	EPA 6010C	10	MCL	10	<10	<10	<10	<10
Barium, Total	ug/L	EPA 6010C	10	MCL	2,000	190	240	240	64
Beryllium, Total	ug/L	EPA 6010C	5	MCL	2	<5.0	<5.0	<5.0	<5.0
Boron, Total	ug/L	EPA 6010C	10	HBSL	5,000	51	26	25	23
Cadmium, Total	ug/L	EPA 6010C	5	MCL	5	<5.0	<5.0	<5.0	<5.0
Calcium, Total	mg/L	EPA 6010C	2	—	—	72	89	82	100
Cobalt, Total	ug/L	EPA 6010C	10	HBSL	2	<10	<10	<10	<10
Copper, Total	ug/L	EPA 6010C	10	MCL	1,300	<10	<10	<10	<10
Iron, Total	ug/L	EPA 6010C	40	HBSL, SMCL	4,000, 300	<40	**1,700**	**1,600**	**3,000**
Lead, Total	ug/L	EPA 6010C	10	MCL	15	<10	<10	<10	<10
Lithium, Total	ug/L	EPA 6010C	10	HBLS	10	<10.0	<10.0	<10.0	<10.0

Magnesium, Total	mg/L	EPA 6010C	0.2	—	—	30	31	28	38
Spring 2025 Baseline Parameters	**Units**	**Method**	**PQL**	**Type**	**Value**	**BUT10014**	**BUT10016**	**BUT10017**	**CLA10011**
Manganese, Total	ug/L	EPA 6010C	10	HBSL, SMCL	300, 50	<10	**460**	**450**	**60**
Nickel, Total	ug/L	EPA 6010C	10	HBSL	10	<10	<10	<10	<10
Potassium, Total	mg/L	EPA 6010C	1	—	—	3.4	1.4	1.3	<1.0
Silica, Total	mg/L	EPA 6010C	2.4	—	—	11	15	14	16
Silver, Total	ug/L	EPA 6010C	5	HBSL	100	<5.0	<5.0	<5.0	<5.0
Sodium, Total	mg/L	EPA 6010C	0.4	—	—	**28**	6.8	6.6	5.1
Strontium, Total	ug/L	EPA 6010C	10	HBSL	4,000	660	460	450	340
Vanadium, Total	ug/L	EPA 6010C	10	—	—	<10	<10	<10	<10
Zinc, Total	ug/L	EPA 6010C	10	HBSL	2,000	<10	<10	<10	<10
Antimony, Total	ug/L	EPA 6020A	3	MCL	6	<3.0	<3.0	<3.0	<3.0
Thallium, Total	ug/L	EPA 6020A	1	MCL	2	<1.0	<1.0	<1.0	<1.0
Uranium, Total	ug/L	EPA 6020A	10	MCL	30	<10	<10	<10	<10
Alkalinity, Total (pH 4.5)	mg/L	SM 2320B-97,11	5	—	—	320	240	270	300
Solids, Dissolved	mg/L	SM 2540C-20	20	SMCL	500	**502**	276	338	442
Chromium, Hexavalent	ug/L	SM 3500-Cr B-20	4	MCL	100	<4.0	<4.0	<4.0	<4.0
Orthophosphate as P	mg/L	SM 4500 P ,E-21	0.01	—	—	<0.01	<0.01	0.01	<0.01
Orthophosphate as PO4	mg/L	SM 4500 P ,E-21	0.03	—	—	<0.03	<0.03	0.04	<0.03
Fluoride	mg/L	SM 4500-F B,C-11	0.1	MCL	4	0.197	0.218	0.141	0.216
Nitrate/Nitrite-N	mg/L	SM 4500-NO3 F-19	0.05	MCL	10	**2.42**	<0.05	**3.37**	<0.05
Nitrite-N	mg/L	SM 4500-NO3 F-19	0.05	MCL	1	<0.05	<0.05	<0.05	<0.05
Phosphorus, Total	mg/L	SM-4500P B,E-21	0.04	—	—	<0.04	1.18	0.67	<0.04
Carbonaceous BOD	mg/L	SM 5210 B-16	4	—	—	<2.0	<2.0	<2.0	40
Total Organic Carbon	mg/L	SM 5310B-00,14	0.7	—	—	<0.7	<0.7	0.7	0.8
E. coli	MPN/100mL	SM-9223 B	1	MCL	0	<1	<1	<1	<1
Spring 2025 Baseline Parameters	**Units**	**Method**	**PQL**	**Type**	**Value**	**CLA10018**	**DAR00006**	**HAM00010**	**MIA00205**
Dissolved Oxygen	mg/L	Field Measured	—	—	—	7.04	0.06	10.68	0.04
Oxidation Reduction Potential	mV	Field Measured	—	—	—	74.60	-142.40	117.90	59.00

pH	S.U.	Field Measured	—	SMCL	6.5 - 8.5	7.18	7.27	7.02	7.21

Spring 2025 **Baseline Parameters**	**Units**	**Method**	**PQL**	**Type**	**Value**	**CLA10018**	**DAR00006**	**HAM00010**	**MIA00205**
Specific Conductance	mS/cm	Field Measured	—	—	—	684	733	877	676
Temperature	°C	Field Measured	—	—	—	13.3	11.9	13.2	12.3
Total Kjeldahl Nitrogen	mg/L	EPA 351.2	0.5	—	—	<0.50	<0.50	<0.50	<0.50
Hardness (Calc. as CaCO3)	mg/L	EPA 200.7 Rev. 4.4	5	—	—	347	382	440	347
Chloride	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	22	7.2	**44**	23
Sulfate	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	13	47	35	25
Cyanide, Total	mg/L	EPA 335.4 Rev. 1.0	0.005	MCL	0.2	<0.005	<0.005	<0.005	<0.005
Ammonia-N	mg/L	EPA 350.1 Rev. 2.0	0.05	—	—	<0.05	0.11	0.05	0.12
Nitrate-N	mg/L	EPA 353.2 Rev. 2.0	0.05	MCL	10	**10.7**	<0.05	2.01	**3.35**
Chemical Oxygen Demand	mg/L	EPA 410.4 Rev 2.0	10	—	—	<10	<10	<10	<10
Phenolics (as Phenol), Total	mg/L	EPA 420.4 Rev. 1.0	0.05	—	—	<0.05	<0.05	<0.05	<0.05
Aluminum, Total	ug/L	EPA 6010C	150	HBSL, SMCL	70, 50	<150	<150	<150	<150
Arsenic, Total	ug/L	EPA 6010C	10	MCL	10	<10	<10	<10	<10
Barium, Total	ug/L	EPA 6010C	10	MCL	2,000	73	120	110	120
Beryllium, Total	ug/L	EPA 6010C	5	MCL	2	<5.0	<5.0	<5.0	<5.0
Boron, Total	ug/L	EPA 6010C	10	HBSL	5,000	30	17	58	<200
Cadmium, Total	ug/L	EPA 6010C	5	MCL	5	<5.0	<5.0	<5.0	<5.0
Calcium, Total	mg/L	EPA 6010C	2	—	—	82	97	120	95
Cobalt, Total	ug/L	EPA 6010C	10	HBSL	2	<10	<10	<10	<10
Copper, Total	ug/L	EPA 6010C	10	MCL	1,300	<10	<10	<10	<10
Iron, Total	ug/L	EPA 6010C	40	HBSL, SMCL	4,000, 300	<40	**1,900**	73	<40
Lead, Total	ug/L	EPA 6010C	10	MCL	15	<10	<10	<10	<10
Lithium, Total	ug/L	EPA 6010C	10	HBLS	10	<10.0	<10.0	<10.0	<10.0
Magnesium, Total	mg/L	EPA 6010C	0.2	—	—	38	**34**	33	**29**
Manganese, Total	ug/L	EPA 6010C	10	HBSL, SMCL	300, 50	<10	<10	<10	64
Nickel, Total	ug/L	EPA 6010C	10	HBSL	10	<10	<10	<10	<10
Potassium, Total	mg/L	EPA 6010C	1	—	—	1.8	1.2	2.8	1.2
Silica, Total	mg/L	EPA 6010C	2.4	—	—	9	18	10	9.2

Silver, Total	ug/L	EPA 6010C	5	HBSL	100	<5.0	**<5.0**	**<5.0**	<5.0
Spring 2025 Baseline Parameters	**Units**	**Method**	**PQL**	**Type**	**Value**	**CLA10018**	**DAR00006**	**HAM00010**	**MIA00205**
Sodium, Total	mg/L	EPA 6010C	0.4	—	—	7.3	5	26	10
Strontium, Total	ug/L	EPA 6010C	10	HBSL	4,000	2000	1600	500	350
Vanadium, Total	ug/L	EPA 6010C	10	—	—	<10	<10	<10	<10
Zinc, Total	ug/L	EPA 6010C	10	HBSL	2,000	<10	<10	<10	<10
Antimony, Total	ug/L	EPA 6020A	3	MCL	6	<3.0	<3.0	<3.0	<3.0
Thallium, Total	ug/L	EPA 6020A	1	MCL	2	<1.0	<1.0	<1.0	<1.0
Uranium, Total	ug/L	EPA 6020A	10	MCL	30	<10	<10	<10	<10
Alkalinity, Total (pH 4.5)	mg/L	SM 2320B-97,11	5	—	—	**280**	300	380	300
Solids, Dissolved	mg/L	SM 2540C-20	20	SMCL	500	374	448	574	458
Chromium, Hexavalent	ug/L	SM 3500-Cr B-20	4	MCL	100	<4.0	<4.0	<4.0	<20
Orthophosphate as P	mg/L	SM 4500 P ,E-21	0.01	—	—	<0.01	<0.01	0.02	<0.01
Orthophosphate as PO4	mg/L	SM 4500 P ,E-21	0.03	—	—	<0.03	<0.03	0.05	<0.03
Fluoride	mg/L	SM 4500-F B,C-11	0.1	MCL	4	0.163	0.624	0.171	0.158
Nitrate/Nitrite-N	mg/L	SM 4500-NO3 F-19	0.05	MCL	10	10.7	<0.05	2.02	3.36
Nitrite-N	mg/L	SM 4500-NO3 F-19	0.05	MCL	1	<0.05	<0.05	<0.05	<0.05
Phosphorus, Total	mg/L	SM-4500P B,E-21	0.04	—	—	2	<0.04	0.04	<0.04
Carbonaceous BOD	mg/L	SM 5210 B-16	4	—	—	<0.04	<4.0	<2.0	<2.0
Total Organic Carbon	mg/L	SM 5310B-00,14	0.7	—	—	<0.7	<0.7	<0.7	<0.7
E. coli	MPN/100mL	SM-9223 B	1	MCL	0	<1	<1	<1	<1
Spring 2025 Baseline Parameters	**Units**	**Method**	**PQL**	**Type**	**Value**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**
Dissolved Oxygen	mg/L	Field Measured	—	—	—	0.02	0.00	0.53	0.05
Oxidation Reduction Potential	mV	Field Measured	—	—	—	-102.00	-98.00	-122.00	63.90
pH	S.U.	Field Measured	—	SMCL	6.5 - 8.5	6.98	7.26	7.30	7.20
Specific Conductance	mS/cm	Field Measured	—	—	—	839	734	740	657
Temperature	°C	Field Measured	—	—	—	13.4	12.7	19.5	12.2
Total Kjeldahl Nitrogen	mg/L	EPA 351.2	0.5	—	—	0.82	1.19	<0.50	<0.50
Hardness (Calc. as CaCO3)	mg/L	EPA 200.7 Rev. 4.4	5	—	—	442	302	334	345

Chloride	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	15	**58**	**49**	8
Spring 2025 Baseline Parameters	**Units**	**Method**	**PQL**	**Type**	**Value**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**
Sulfate	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	110	29	48	33
Cyanide, Total	mg/L	EPA 335.4 Rev. 1.0	0.005	MCL	0.2	<0.005	<0.005	<0.005	<0.005
Ammonia-N	mg/L	EPA 350.1 Rev. 2.0	0.05	—	—	0.05	<0.05	<0.05	0.07
Nitrate-N	mg/L	EPA 353.2 Rev. 2.0	0.05	MCL	10	<0.05	<0.05	<0.10	<0.05
Chemical Oxygen Demand	mg/L	EPA 410.4 Rev 2.0	10	—	—	<10	17	<10	<10
Phenolics (as Phenol), Total	mg/L	EPA 420.4 Rev. 1.0	0.05	—	—	<0.05	<0.05	<0.05	<0.05
Aluminum, Total	ug/L	EPA 6010C	150	HBSL, SMCL	70, 50	<150	**11,000**	<150	<150
Arsenic, Total	ug/L	EPA 6010C	10	MCL	10	<10	<10	<10	<10
Barium, Total	ug/L	EPA 6010C	10	MCL	2,000	79	110	290	160
Beryllium, Total	ug/L	EPA 6010C	5	MCL	2	<5.0	<5.0	<5.0	<5.0
Boron, Total	ug/L	EPA 6010C	10	HBSL	5,000	50	54	37	40
Cadmium, Total	ug/L	EPA 6010C	5	MCL	5	<5.0	<5.0	<5.0	<5.0
Calcium, Total	mg/L	EPA 6010C	2	—	—	120	82	90	90
Cobalt, Total	ug/L	EPA 6010C	10	HBSL	2	<10	<10	<10	<10
Copper, Total	ug/L	EPA 6010C	10	MCL	1,300	<10	<10	<10	<10
Iron, Total	ug/L	EPA 6010C	40	HBSL, SMCL	4,000, 300	**71,000**	400	**6,200**	210
Lead, Total	ug/L	EPA 6010C	10	MCL	15	<10	<10	<10	<10
Lithium, Total	ug/L	EPA 6010C	10	HBLS	10	<10.0	<10.0	<10.0	<10.0
Magnesium, Total	mg/L	EPA 6010C	0.2	—	—	36	28	36	35
Manganese, Total	ug/L	EPA 6010C	10	HBSL, SMCL	300, 50	21	**74**	23	**300**
Nickel, Total	ug/L	EPA 6010C	10	HBSL	10	<10	<10	<10	<10
Potassium, Total	mg/L	EPA 6010C	1	—	—	3.3	2.6	2.3	1.3
Silica, Total	mg/L	EPA 6010C	2.4	—	—	8	10	12	12
Silver, Total	ug/L	EPA 6010C	5	HBSL	100	<5.0	<5.0	<5.0	<5.0
Sodium, Total	mg/L	EPA 6010C	0.4	—	—	11	**36**	**27**	10
Strontium, Total	ug/L	EPA 6010C	10	HBSL	4,000	400	600	760	480
Vanadium, Total	ug/L	EPA 6010C	10	—	—	<10	<10	<10	<10
Zinc, Total	ug/L	EPA 6010C	10	HBSL	2,000	<10	<10	<10	<10

Antimony, Total	ug/L	EPA 6020A	3	MCL	6	<3.0	<3.0	<3.0	<3.0

Spring 2025 Baseline Parameters	Units	Method	PQL	Type	Value	MON00022	MON10016	PRE10007	SHE00089
Thallium, Total	ug/L	EPA 6020A	1	MCL	2	<1.0	<1.0	<1.0	<1.0
Uranium, Total	ug/L	EPA 6020A	10	MCL	30	<10	<10	<10	<10
Alkalinity, Total (pH 4.5)	mg/L	SM 2320B-97,11	5	—	—	350	250	280	310
Solids, Dissolved	mg/L	SM 2540C-20	20	SMCL	500	**550**	488	410	396
Chromium, Hexavalent	ug/L	SM 3500-Cr B-20	4	MCL	100	<4.0	<4.0	<4.0	<4.0
Orthophosphate as P	mg/L	SM 4500 P ,E-21	0.01	—	—	<0.01	<0.01	<0.01	<0.01
Orthophosphate as PO4	mg/L	SM 4500 P ,E-21	0.03	—	—	<0.03	<0.03	<0.03	<0.03
Fluoride	mg/L	SM 4500-F B,C-11	0.1	MCL	4	0.167	0.116	0.153	0.333
Nitrate/Nitrite-N	mg/L	SM 4500-NO3 F-19	0.05	MCL	10	<0.05	<0.05	<0.05	<0.50
Nitrite-N	mg/L	SM 4500-NO3 F-19	0.05	MCL	1	<0.05	<0.05	<0.05	<0.05
Phosphorus, Total	mg/L	SM-4500P B,E-21	0.04	—	—	<0.04	<0.04	1	<0.04
Carbonaceous BOD	mg/L	SM 5210 B-16	4	—	—	<2.0	<2.0	<2.0	<2.0
Total Organic Carbon	mg/L	SM 5310B-00,14	0.7	—	—	1.3	<0.7	<0.7	<0.7
E. coli	MPN/100mL	SM-9223 B	1	MCL	0	<1	<1	<1	<1

Spring 2025 Baseline Parameters	Units	Method	PQL	Type	Value	WAR10003	WAR10004
Dissolved Oxygen	mg/L	Field Measured	—	—	—	0	3.31
Oxidation Reduction Potential	mV	Field Measured	—	—	—	-150.4	65.10
pH	S.U.	Field Measured	—	SMCL	6.5 - 8.5	7.19	7.37
Specific Conductance	mS/cm	Field Measured	—	—	—	745	745
Temperature	°C	Field Measured	—	—	—	14.5	14.7
Total Kjeldahl Nitrogen	mg/L	EPA 351.2	0.5	—	—	<0.50	<0.50
Hardness (Calc. as CaCO3)	mg/L	EPA 200.7 Rev. 4.4	5	—	—	428	255
Chloride	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	**130**	**38**
Sulfate	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	82	21
Cyanide, Total	mg/L	EPA 335.4 Rev. 1.0	0.005	MCL	0.2	<0.005	<0.005
Ammonia-N	mg/L	EPA 350.1 Rev. 2.0	0.05	—	—	0.26	<0.05
Nitrate-N	mg/L	EPA 353.2 Rev. 2.0	0.05	MCL	10	<0.10	**3.15**

Chemical Oxygen Demand	mg/L	EPA 410.4 Rev 2.0	10	—	—	15	<10
Spring 2025 Baseline Parameters	**Units**	**Method**	**PQL**	**Type**	**Value**	**WAR10003**	**WAR10004**
Phenolics (as Phenol), Total	mg/L	EPA 420.4 Rev. 1.0	0.05	—	—	<0.05	<0.05
Aluminum, Total	ug/L	EPA 6010C	150	HBSL, SMCL	70, 50	<150	<150
Arsenic, Total	ug/L	EPA 6010C	10	MCL	10	<10	<10
Barium, Total	ug/L	EPA 6010C	10	MCL	2,000	210	59
Beryllium, Total	ug/L	EPA 6010C	5	MCL	2	<5.0	<5.0
Boron, Total	ug/L	EPA 6010C	10	HBSL	5,000	230	74
Cadmium, Total	ug/L	EPA 6010C	5	MCL	5	<5.0	<5.0
Calcium, Total	mg/L	EPA 6010C	2	—	—	94	55
Cobalt, Total	ug/L	EPA 6010C	10	HBSL	2	<10	<10
Copper, Total	ug/L	EPA 6010C	10	MCL	1,300	<10	<10
Iron, Total	ug/L	EPA 6010C	40	HBSL, SMCL	4,000, 300	**2,200**	<40
Lead, Total	ug/L	EPA 6010C	10	MCL	15	<10	<10
Lithium, Total	ug/L	EPA 6010C	10	HBLS	10	<10.0	<10.0
Magnesium, Total	mg/L	EPA 6010C	0.2	—	—	45	25
Manganese, Total	ug/L	EPA 6010C	10	HBSL, SMCL	300, 50	<10	<10
Nickel, Total	ug/L	EPA 6010C	10	HBSL	10	<10	<10
Potassium, Total	mg/L	EPA 6010C	1	—	—	3.3	2.6
Silica, Total	mg/L	EPA 6010C	2.4	—	—	14	8.3
Silver, Total	ug/L	EPA 6010C	5	HBSL	100	<5.0	<5.0
Sodium, Total	mg/L	EPA 6010C	0.4	—	—	**57**	**24**
Strontium, Total	ug/L	EPA 6010C	10	HBSL	4,000	1100	420
Vanadium, Total	ug/L	EPA 6010C	10	—	—	<10	<10
Zinc, Total	ug/L	EPA 6010C	10	HBSL	2,000	<10	<10
Antimony, Total	ug/L	EPA 6020A	3	MCL	6	<3.0	<3.0
Thallium, Total	ug/L	EPA 6020A	1	MCL	2	<1.0	<1.0
Uranium, Total	ug/L	EPA 6020A	10	MCL	30	<10	<10
Alkalinity, Total (pH 4.5)	mg/L	SM 2320B-97,11	5	—	—	280	210
Solids, Dissolved	mg/L	SM 2540C-20	20	SMCL	500	**588**	326

Chromium, Hexavalent	ug/L	SM 3500-Cr B-20	4	MCL	100	<4.0	<4.0

Spring 2025 Baseline Parameters	Units	Method	PQL	Type	Value	WAR10003	WAR10004
Orthophosphate as P	mg/L	SM 4500 P ,E-21	0.01	—	—	<0.01	<0.01
Orthophosphate as PO4	mg/L	SM 4500 P ,E-21	0.03	—	—	<0.03	<0.03
Fluoride	mg/L	SM 4500-F B,C-11	0.1	MCL	4	0.169	0.211
Nitrate/Nitrite-N	mg/L	SM 4500-NO3 F-19	0.05	MCL	10	<0.05	**3.16**
Nitrite-N	mg/L	SM 4500-NO3 F-19	0.05	MCL	1	<0.05	<0.05
Phosphorus, Total	mg/L	SM-4500P B,E-21	0.04	—	—	<0.04	<0.04
Carbonaceous BOD	mg/L	SM 5210 B-16	4	—	—	<2.0	<2.0
Total Organic Carbon	mg/L	SM 5310B-00,14	0.7	—	—	<0.7	<0.7
E. coli	MPN/100mL	SM-9223 B	1	MCL	0	<1	<1

MCL – Maximum Contaminant Level set by USEPA
SMCL – Secondary Maximum Contaminant Level set by USEPA
HBSL – Non enforceable Health Based Screening Level based on (1) latest USEPA Office of Water policies for establishing drinking water benchmarks and (2) most recent USEPA peer reviewed toxicity information
— No drinking water benchmark set for the compound
J – Estimated value
B – Analyte was detected in method blank at or above method reporting limit
Numbers in bold exceed a benchmark and/or likely reflect anthropogenic sources

Spring 2025 PFAS Compounds	Units	Method	PQL	Type	Value	BUT10014	BUT10016	BUT10017	CLA10011
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1	< 3.1	< 3.1
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1	< 3.1	< 3.1
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1	< 3.1	< 3.1
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8	< 7.8	< 7.8
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8	< 7.8	< 7.8
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1	< 3.1	< 3.1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ng/L	EPA 1633	1.2	MCL	10	< 1.2	< 1.2	< 1.2	< 1.2
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8	< 7.8	< 7.8
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
N-methylperfluorooctane sulfonamide (NMeFOSA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8	< 7.8	< 7.8
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoro-3-methoxypropanoic acid (PFMPA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoro-4-methoxybutanoic acid (PFMBA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorobutanesulfonic acid (PFBS)	ng/L	EPA 1633	1.6	Proposed MCL	2,000	**2**	< 1.6	**7.4**	< 1.6
Perfluorobutanoic acid (PFBA)	ng/L	EPA 1633	3.1	HBSL	6,000	**1.5J**	< 3.1	**2.5J**	< 3.1
Perfluorodecanesulfonic acid (PFDS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorodecanoic acid (PFDA)	ng/L	EPA 1633	1.6	HBSL	0.002	< 1.6	< 1.6	< 1.6	< 1.6

Perfluorododecanesulfonic acid (PFDoS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Spring 2025 **PFAS Compounds**	**Units**	**Method**	**PQL**	**Type**	**Value**	**BUT10014**	**BUT10016**	**BUT10017**	**CLA10011**
Perfluorododecanoic acid (PFDoA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoroheptanesulfonic acid (PFHpS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoroheptanoic acid (PFHpA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	**1.2J**	< 1.6
Perfluorohexanesulfonic acid (PFHxS)	ng/L	EPA 1633	1.6	MCL	10	**2.5**	< 1.6	**1J**	< 1.6
Perfluorohexanoic acid (PFHxA)	ng/L	EPA 1633	1.6	HBSL	3,000	**0.7J**	< 1.6	**3.7**	< 1.6
Perfluorononanesulfonic acid (PFNS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorononanoic acid (PFNA)	ng/L	EPA 1633	1.6	MCL	10	**2.6**	< 1.6	< 1.6	< 1.6
Perfluorooctanesulfonamide (PFOSA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorooctanesulfonic acid (PFOS)	ng/L	EPA 1633	1.6	MCL	4	**7.7**	< 1.6	**10I**	< 1.6
Perfluorooctanoic acid (PFOA)	ng/L	EPA 1633	1.6	MCL	4	**8.8**	< 1.6	**11**	< 1.6
Perfluoropentanesulfonic acid (PFPeS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoropentanoic acid (PFPeA)	ng/L	EPA 1633	1.6	—	—	**0.47J**	< 1.6	**4.2**	< 1.6
Perfluorotetradecanoic acid (PFTeDA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorotridecanoic acid (PFTrDA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoroundecanoic acid (PFUnA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Spring 2025 **PFAS Compounds**	**Units**	**Method**	**PQL**	**Type**	**Value**	**CLA10018**	**DAR00006**	**HAM00010**	**MIA00205**
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1	< 3.1	< 3.1
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1	< 3.1	< 3.1
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1	< 3.1	< 3.1
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8	< 7.8	< 7.8
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8	< 7.8	< 7.8
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1	< 3.1	< 3.1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6

9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Spring 2025 **PFAS Compounds**	**Units**	**Method**	**PQL**	**Type**	**Value**	**CLA10018**	**DAR00006**	**HAM00010**	**MIA00205**
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ng/L	EPA 1633	1.2	MCL	10	< 1.2	< 1.2	< 1.2	< 1.2
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8	< 7.8	< 7.8
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
N-methylperfluorooctane sulfonamide (NMeFOSA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8	< 7.8	< 7.8
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ng/L	EPA 1633	1.6	—	—	< 1.6	**2.5**	< 1.6	< 1.6
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoro-3-methoxypropanoic acid (PFMPA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoro-4-methoxybutanoic acid (PFMBA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorobutanesulfonic acid (PFBS)	ng/L	EPA 1633	1.6	Proposed MCL	2,000	< 1.6	< 1.6	**3.5**	< 1.6
Perfluorobutanoic acid (PFBA)	ng/L	EPA 1633	3.1	HBSL	6,000	< 3.1	< 3.1	**3.7**	< 3.1
Perfluorodecanesulfonic acid (PFDS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorodecanoic acid (PFDA)	ng/L	EPA 1633	1.6	HBSL	0.002	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorododecanesulfonic acid (PFDoS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorododecanoic acid (PFDoA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoroheptanesulfonic acid (PFHpS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoroheptanoic acid (PFHpA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	**0.91J**	< 1.6
Perfluorohexanesulfonic acid (PFHxS)	ng/L	EPA 1633	1.6	MCL	10	< 1.6	< 1.6	**3**	< 1.6
Perfluorohexanoic acid (PFHxA)	ng/L	EPA 1633	1.6	HBSL	3,000	< 1.6	< 1.6	**1.3J**	< 1.6
Perfluorononanesulfonic acid (PFNS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorononanoic acid (PFNA)	ng/L	EPA 1633	1.6	MCL	10	< 1.6	< 1.6	**0.4J**	< 1.6
Perfluorooctanesulfonamide (PFOSA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorooctanesulfonic acid (PFOS)	ng/L	EPA 1633	1.6	MCL	4	< 1.6	**0.4J**	**2.4I**	< 1.6

Perfluorooctanoic acid (PFOA)	ng/L	EPA 1633	1.6	MCL	4	< 1.6	< 1.6	**4.8**	< 1.6
Perfluoropentanesulfonic acid (PFPeS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoropentanoic acid (PFPeA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	**1.4J**	< 1.6
Perfluorotetradecanoic acid (PFTeDA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorotridecanoic acid (PFTrDA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoroundecanoic acid (PFUnA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6

Spring 2025 **PFAS Compounds**	**Units**	**Method**	**PQL**	**Type**	**Value**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1	< 3.1	< 3.1
1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1	< 3.1	< 3.1
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1	< 3.1	< 3.1
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8	< 7.8	< 7.8
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8	< 7.8	< 7.8
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1	< 3.1	< 3.1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ng/L	EPA 1633	1.2	MCL	10	< 1.2	< 1.2	< 1.2	< 1.2
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8	< 7.8	< 7.8
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
N-methylperfluorooctane sulfonamide (NMeFOSA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8	< 7.8	< 7.8
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ng/L	EPA 1633	1.6	—	—	< 1.6	**1.9**	< 1.6	< 1.6
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6

Perfluoro-3-methoxypropanoic acid (PFMPA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoro-4-methoxybutanoic acid (PFMBA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6

Spring 2025 **PFAS Compounds**	**Units**	**Method**	**PQL**	**Type**	**Value**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**
Perfluorobutanesulfonic acid (PFBS)	ng/L	EPA 1633	1.6	Proposed MCL	2,000	**0.85J**	**1.7**	**0.62J**	< 1.6
Perfluorobutanoic acid (PFBA)	ng/L	EPA 1633	3.1	HBSL	6,000	**2.2J**	**4.3**	**1.4J**	< 3.1
Perfluorodecanesulfonic acid (PFDS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorodecanoic acid (PFDA)	ng/L	EPA 1633	1.6	HBSL	0.002	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorododecanesulfonic acid (PFDoS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorododecanoic acid (PFDoA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoroheptanesulfonic acid (PFHpS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoroheptanoic acid (PFHpA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorohexanesulfonic acid (PFHxS)	ng/L	EPA 1633	1.6	MCL	10	< 1.6	**0.89J**	< 1.6	< 1.6
Perfluorohexanoic acid (PFHxA)	ng/L	EPA 1633	1.6	HBSL	3,000	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorononanesulfonic acid (PFNS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorononanoic acid (PFNA)	ng/L	EPA 1633	1.6	MCL	10	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorooctanesulfonamide (PFOSA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorooctanesulfonic acid (PFOS)	ng/L	EPA 1633	1.6	MCL	4	**0.63J**	**0.4J**	< 1.6	< 1.6
Perfluorooctanoic acid (PFOA)	ng/L	EPA 1633	1.6	MCL	4	**0.82J**	< 1.6	< 1.6	< 1.6
Perfluoropentanesulfonic acid (PFPeS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoropentanoic acid (PFPeA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	**0.52J**	< 1.6
Perfluorotetradecanoic acid (PFTeDA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluorotridecanoic acid (PFTrDA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6
Perfluoroundecanoic acid (PFUnA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6	< 1.6	< 1.6

Spring 2025 **PFAS Compounds**	**Units**	**Method**	**PQL**	**Type**	**Value**	**WAR10003**	**WAR10004**		
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6		
1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2 FTS)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1		

1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2 FTS)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1
1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2 FTS)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8

Spring 2025 **PFAS Compounds**	**Units**	**Method**	**PQL**	**Type**	**Value**	**WAR10003**	**WAR10004**
3-Perfluoropentylpropanoic acid (5:3 FTCA)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8
3-Perfluoropropylpropanoic acid (3:3 FTCA)	ng/L	EPA 1633	3.1	—	—	< 3.1	< 3.1
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	ng/L	EPA 1633	1.2	MCL	10	< 1.2	< 1.2
N-ethylperfluorooctane sulfonamide (NEtFOSA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
N-ethylperfluorooctane sulfonamidoethanol (NEtFOSE)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
N-methylperfluorooctane sulfonamide (NMeFOSA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
N-methylperfluorooctane sulfonamidoethanol (NMeFOSE)	ng/L	EPA 1633	7.8	—	—	< 7.8	< 7.8
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Perfluoro-3-methoxypropanoic acid (PFMPA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Perfluoro-4-methoxybutanoic acid (PFMBA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Perfluorobutanesulfonic acid (PFBS)	ng/L	EPA 1633	1.6	Proposed MCL	2,000	< 1.6	**0.77J**
Perfluorobutanoic acid (PFBA)	ng/L	EPA 1633	3.1	HBSL	6,000	**1.8J**	< 3.1
Perfluorodecanesulfonic acid (PFDS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Perfluorodecanoic acid (PFDA)	ng/L	EPA 1633	1.6	HBSL	0.002	< 1.6	< 1.6
Perfluorododecanesulfonic acid (PFDoS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Perfluorododecanoic acid (PFDoA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6

Perfluoroheptanesulfonic acid (PFHpS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Perfluoroheptanoic acid (PFHpA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Perfluorohexanesulfonic acid (PFHxS)	ng/L	EPA 1633	1.6	MCL	10	< 1.6	**0.54J**
Perfluorohexanoic acid (PFHxA)	ng/L	EPA 1633	1.6	HBSL	3,000	< 1.6	**0.54J**
Perfluorononanesulfonic acid (PFNS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Spring 2025 **PFAS Compounds**	**Units**	**Method**	**PQL**	**Type**	**Value**	**WAR10003**	**WAR10004**
Perfluorononanoic acid (PFNA)	ng/L	EPA 1633	1.6	MCL	10	< 1.6	< 1.6
Perfluorooctanesulfonamide (PFOSA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Perfluorooctanesulfonic acid (PFOS)	ng/L	EPA 1633	1.6	MCL	4	< 1.6	**0.72J**
Perfluorooctanoic acid (PFOA)	ng/L	EPA 1633	1.6	MCL	4	< 1.6	**0.88J**
Perfluoropentanesulfonic acid (PFPeS)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Perfluoropentanoic acid (PFPeA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Perfluorotetradecanoic acid (PFTeDA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Perfluorotridecanoic acid (PFTrDA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6
Perfluoroundecanoic acid (PFUnA)	ng/L	EPA 1633	1.6	—	—	< 1.6	< 1.6

Fall 2025 Baseline Parameters	Units	Method	PQL	Type	Value	BUT10014	BUT10016	BUT10017	CLA10011
Dissolved Oxygen	mg/L	Field Measured	—	—	—	5.46	0.05	8.52	0.00
Oxidation Reduction Potential	mV	Field Measured	—	—	—	167.0	-154.3	96.7	-128.8
pH	S.U.	Field Measured	—	SMCL	6.5 - 8.5	7.19	7.49	7.24	7.22
Specific Conductance	mS/cm	Field Measured	—	—	—	NA	566	617	557
Temperature	°C	Field Measured	—	—	—	14.8	13.3	13.6	12.8
Total Kjeldahl Nitrogen	mg/L	EPA 351.2	0.5	—	—	<0.50	<0.50	<0.50	<0.50
Hardness (Calc. as CaCO3)	mg/L	EPA 200.7 Rev. 4.4	5	—	—	354	296	335	428
Chloride	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	**40**	14	15	26
Sulfate	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	29	50	12	61
Cyanide, Total	mg/L	EPA 335.4 Rev. 1.0	0.005	MCL	0.2	<0.005	<0.005	<0.005	<0.005
Ammonia-N	mg/L	EPA 350.1 Rev. 2.0	0.05	—	—	<0.05	0.14	<0.05	<0.05
Nitrate-N	mg/L	EPA 353.2 Rev. 2.0	0.5	MCL	10	2.07	<0.50	**4.75**	<0.50
Chemical Oxygen Demand	mg/L	EPA 410.4 Rev 2.0	10	—	—	<10	<10	13	<10
Phenolics (as Phenol), Total	mg/L	EPA 420.4 Rev. 1.0	0.05	—	—	< 0.05	<0.05	<0.05	<0.05
Aluminum, Total	ug/L	EPA 6010C	150	HBSL, SMCL	70, 50	<150	<150	<150	<150
Arsenic, Total	ug/L	EPA 6010C	10	MCL	10	<10	<10	<10	<10
Barium, Total	ug/L	EPA 6010C	10	MCL	2,000	190	240	46	70
Beryllium, Total	ug/L	EPA 6010C	5	MCL	2	<5.0	<5.0	<5.0	<5.0
Boron, Total	ug/L	EPA 6010C	50	HBSL	5,000	59	<50	<50	<10
Cadmium, Total	ug/L	EPA 6010C	5	MCL	5	<5.0	<5.0	<5.0	<5.0
Calcium, Total	mg/L	EPA 6010C	2	—	—	120	78	89	110

Cobalt, Total	ug/L	EPA 6010C	10	HBSL	2	<10	<10	<10	<10
Copper, Total	ug/L	EPA 6010C	10	MCL	1,300	<10	<10	<10	<10
Iron, Total	ug/L	EPA 6010C	40	HBSL, SMCL	4,000, 300	<40	**1700**	<40	**3100**
Lead, Total	ug/L	EPA 6010C	10	MCL	15	<10	<10	<10	<10
Lithium, Total	ug/L	EPA 6010C	10	HBLS	10	<10.0	<10	<10	<10.0
Fall 2025 **Baseline Parameters**	**Units**	**Method**	**PQL**	**Type**	**Value**	**BUT10014**	**BUT10016**	**BUT10017**	**CLA10011**
Magnesium, Total	mg/L	EPA 6010C	2	—	—	30	27	26	39
Manganese, Total	ug/L	EPA 6010C	10	HBSL, SMCL	300, 50	<10	**740**	<10	**64**
Nickel, Total	ug/L	EPA 6010C	10	HBSL	10	<10	<10	<10	<10
Potassium, Total	mg/L	EPA 6010C	1	—	—	3.2	1.3	2.2	<1.0
Silica, Total	mg/L	EPA 6010C	2.4	—	—	12	15	12	7.7
Silver, Total	ug/L	EPA 6010C	5	HBSL	100	<5.0	<5.0	<5.0	<5.0
Sodium, Total	mg/L	EPA 6010C	0.4	—	—	**30**	6.6	6.8	5.4
Strontium, Total	ug/L	EPA 6010C	10	HBSL	4,000	620	450	170	360
Vanadium, Total	ug/L	EPA 6010C	10	—	—	<10	<10	<10	<10
Zinc, Total	ug/L	EPA 6010C	10	HBSL	2,000	<10	<10	<10	<10
Antimony, Total	ug/L	EPA 6020A	15	MCL	6	<15	<3.0	<3.0	<3.0
Thallium, Total	ug/L	EPA 6020A	5	MCL	2	<5.0	<1.0	<1.0	<1.0
Uranium, Total	ug/L	EPA 6020A	50	MCL	30	<50	<10	<10	<10
Alkalinity, Total (pH 4.5)	mg/L	SM 2320B-97,11	5	—	—	260	210	280	290
Solids, Dissolved	mg/L	SM 2540C-20	20	SMCL	500	424	330	336	468
Chromium, Hexavalent	ug/L	SM 3500-Cr B-20	4	MCL	100	<4.0	<4.0	<4.0	<4.0
Orthophosphate as P	mg/L	SM 4500 P ,E-21	0.01	—	—	<0.01	0.01	0.01	<0.01
Orthophosphate as PO4	mg/L	SM 4500 P ,E-21	0.03	—	—	<0.03	0.03	0.03	<0.03
Fluoride	mg/L	SM 4500-F B,C-11, SM 4500-F C-97	0.1	MCL	4	0.211	0.222	0.148	0.245
Nitrate/Nitrite-N	mg/L	SM 4500-NO3 F-19	0.5	MCL	10	2.07	<0.50	**4.75**	<0.50
Nitrite-N	mg/L	SM 4500-NO3 F-19	0.05	MCL	1	<0.05	<0.05	<0.05	<0.05
Phosphorus, Total	mg/L	SM-4500P B,E-21	0.04	—	—	0.05	0.12	<0.04	<0.04
Carbonaceous BOD	mg/L	SM 5210 B-16	2	—	—	<2.0	<2.0	<2.0	<4.0

Total Organic Carbon	mg/L	SM 5310B-00,14	0.7	—	—	0.8	<0.7	<0.7	1.1
E. coli	MPN/100mL	SM-9223 B	1	MCL	0	<1	**1**	<1	<1
Fall 2025 Baseline Parameters	**Units**	**Method**	**PQL**	**Type**	**Value**	**CLA10018**	**DAR00006**	**HAM00010**	**MIA00205**
Dissolved Oxygen	mg/L	Field Measured	—	—	—	6.17	NA	7.56	0.00
Fall 2025 Baseline Parameters	**Units**	**Method**	**PQL**	**Type**	**Value**	**CLA10018**	**DAR00006**	**HAM00010**	**MIA00205**
Oxidation Reduction Potential	mV	Field Measured	—	—	—	280.4	NA	155.5	175.9
pH	S.U.	Field Measured	—	SMCL	6.5 - 8.5	7.20	NA	7.12	7.22
Specific Conductance	mS/cm	Field Measured	—	—	—	564	NA	723	536
Temperature	°C	Field Measured	—	—	—	17.1	NA	13.2	14.0
Total Kjeldahl Nitrogen	mg/L	EPA 351.2	0.5	—	—	<0.50	<0.50	<0.50	<0.50
Hardness (Calc. as CaCO3)	mg/L	EPA 200.7 Rev. 4.4	5	—	—	326	393	377	362
Chloride	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	20	6	26	24
Sulfate	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	14	45	29	27
Cyanide, Total	mg/L	EPA 335.4 Rev. 1.0	0.005	MCL	0.2	<0.005	<0.005	<0.005	<0.005
Ammonia-N	mg/L	EPA 350.1 Rev. 2.0	0.05	—	—	<0.05	0.10	0.06	<0.05
Nitrate-N	mg/L	EPA 353.2 Rev. 2.0	0.5	MCL	10	**9.58**	<0.50	0.93	**3.72**
Chemical Oxygen Demand	mg/L	EPA 410.4 Rev 2.0	10	—	—	<10	<10	17	15
Phenolics (as Phenol), Total	mg/L	EPA 420.4 Rev. 1.0	0.05	—	—	<0.05	<0.05	<0.05	<0.05
Aluminum, Total	ug/L	EPA 6010C	150	HBSL, SMCL	70, 50	<150	<150	**190**	<150
Arsenic, Total	ug/L	EPA 6010C	10	MCL	10	<10	<10	<10	<10
Barium, Total	ug/L	EPA 6010C	10	MCL	2,000	<10	130	89	130
Beryllium, Total	ug/L	EPA 6010C	5	MCL	2	<5.0	<5.0	<5.0	<5.0
Boron, Total	ug/L	EPA 6010C	50	HBSL	5,000	<10	<10	<50	<50
Cadmium, Total	ug/L	EPA 6010C	5	MCL	5	<5.0	<5.0	<5.0	<5.0
Calcium, Total	mg/L	EPA 6010C	2	—	—	75	95	110	100
Cobalt, Total	ug/L	EPA 6010C	10	HBSL	2	<10	<10	<10	<10
Copper, Total	ug/L	EPA 6010C	10	MCL	1,300	<10	<10	<10	<10

Iron, Total	ug/L	EPA 6010C	40	HBSL, SMCL	4,000, 300	<40	**2100**	**2500**	<40
Fall 2025 Baseline Parameters	**Units**	**Method**	**PQL**	**Type**	**Value**	**CLA10018**	**DAR00006**	**HAM00010**	**MIA00205**
Lead, Total	ug/L	EPA 6010C	10	MCL	15	<10	<10	<10	<10
Lithium, Total	ug/L	EPA 6010C	10	HBLS	10	<10.0	<10.0	<10.0	<10
Fall 2025 Baseline Parameters	**Units**	**Method**	**PQL**	**Type**	**Value**	**CLA10018**	**DAR00006**	**HAM00010**	**MIA00205**
Magnesium, Total	mg/L	EPA 6010C	2	—	—	33	38	27	27
Manganese, Total	ug/L	EPA 6010C	10	HBSL, SMCL	300, 50	<10	**91**	32	**92**
Nickel, Total	ug/L	EPA 6010C	10	HBSL	10	<10	<10	<10	<10
Potassium, Total	mg/L	EPA 6010C	1	—	—	2.4	1.1	2.6	1.5
Silica, Total	mg/L	EPA 6010C	2.4	—	—	5	9.7	14	10
Silver, Total	ug/L	EPA 6010C	5	HBSL	100	<5.0	<5.0	<5.0	<5.0
Sodium, Total	mg/L	EPA 6010C	0.4	—	—	8.3	4.8	**18**	10
Strontium, Total	ug/L	EPA 6010C	10	HBSL	4,000	2400	2000	410	370
Vanadium, Total	ug/L	EPA 6010C	10	—	—	<10	<10	<10	<10
Zinc, Total	ug/L	EPA 6010C	10	HBSL	2,000	<10	<10	<10	19
Antimony, Total	ug/L	EPA 6020A	15	MCL	6	<3.0	<15	<15	<3.0
Thallium, Total	ug/L	EPA 6020A	5	MCL	2	<1.0	<5.0	<5.0	<1.0
Uranium, Total	ug/L	EPA 6020A	50	MCL	30	<10	<50	<50	<10
Alkalinity, Total (pH 4.5)	mg/L	SM 2320B-97,11	5	—	—	280	290	340	280
Solids, Dissolved	mg/L	SM 2540C-20	20	SMCL	500	374	380	410	388
Chromium, Hexavalent	ug/L	SM 3500-Cr B-20	4	MCL	100	<4.0	<40	<40	<4.0
Orthophosphate as P	mg/L	SM 4500 P ,E-21	0.01	—	—	<0.01	<0.01	0.02	<0.01
Orthophosphate as PO4	mg/L	SM 4500 P ,E-21	0.03	—	—	<0.03	<0.03	0.05	<0.03
Fluoride	mg/L	SM 4500-F B,C-11, SM 4500-F C-97	0.1	MCL	4	0.211	0.666	0.229	0.165
Nitrate/Nitrite-N	mg/L	SM 4500-NO3 F-19	0.5	MCL	10	**9.58**	<0.50	0.95	**3.72**
Nitrite-N	mg/L	SM 4500-NO3 F-19	0.05	MCL	1	<0.05	<0.05	<0.05	<0.05
Phosphorus, Total	mg/L	SM-4500P B,E-21	0.04	—	—	<0.04	<0.04	0.08	<0.04
Carbonaceous BOD	mg/L	SM 5210 B-16	2	—	—	<2.0	<2.0	50	<4.0

Total Organic Carbon	mg/L	SM 5310B-00,14	0.7	—	—	<0.7	0.7	0.7	<0.7
E. coli	MPN/100mL	SM-9223 B	1	MCL	0	<1	<1	<1	<1
Fall 2025 Baseline Parameters	**Units**	**Method**	**PQL**	**Type**	**Value**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**
Dissolved Oxygen	mg/L	Field Measured	—	—	—	0.90	0.00	0.20	0.03
Fall 2025 Baseline Parameters	**Units**	**Method**	**PQL**	**Type**	**Value**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**
Oxidation Reduction Potential	mV	Field Measured	—	—	—	56.3	-92.1	-117.2	53.7
pH	S.U.	Field Measured	—	SMCL	6.5 - 8.5	6.91	7.36	7.34	7.27
Specific Conductance	mS/cm	Field Measured	—	—	—	945	740	710	647
Temperature	°C	Field Measured	—	—	—	18.2	13.0	13.4	12.2
Total Kjeldahl Nitrogen	mg/L	EPA 351.2	0.5	—	—	<0.50	<0.50	<0.50	<0.50
Hardness (Calc. as CaCO3)	mg/L	EPA 200.7 Rev. 4.4	5	—	—	533	320	346	367
Chloride	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	16	**62**	**34**	7.6
Sulfate	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	150	32	48	37
Cyanide, Total	mg/L	EPA 335.4 Rev. 1.0	0.005	MCL	0.2	<0.005	<0.005	<0.005	<0.005
Ammonia-N	mg/L	EPA 350.1 Rev. 2.0	0.05	—	—	0.07	<0.05	0.06	0.06
Nitrate-N	mg/L	EPA 353.2 Rev. 2.0	0.5	MCL	10	<0.50	<0.50	<0.50	<0.50
Chemical Oxygen Demand	mg/L	EPA 410.4 Rev 2.0	10	—	—	11	<10	<10	<10
Phenolics (as Phenol), Total	mg/L	EPA 420.4 Rev. 1.0	0.05	—	—	0.08	<0.05	<0.05	<0.05
Aluminum, Total	ug/L	EPA 6010C	150	HBSL, SMCL	70, 50	<150	<150	<150	<150
Arsenic, Total	ug/L	EPA 6010C	10	MCL	10	<10	<10	<10	<10
Barium, Total	ug/L	EPA 6010C	10	MCL	2,000	100	120	240	150
Beryllium, Total	ug/L	EPA 6010C	5	MCL	2	<5.0	<5.0	<5.0	<5.0
Boron, Total	ug/L	EPA 6010C	50	HBSL	5,000	77	<50	<50	<50
Cadmium, Total	ug/L	EPA 6010C	5	MCL	5	<5.0	<5.0	<5.0	<5.0
Calcium, Total	mg/L	EPA 6010C	2	—	—	150	88	95	90
Cobalt, Total	ug/L	EPA 6010C	10	HBSL	2	<10	<10	<10	<10
Copper, Total	ug/L	EPA 6010C	10	MCL	1,300	<10	<10	<10	<10

Iron, Total	ug/L	EPA 6010C	40	HBSL, SMCL	4,000, 300	160	**370**	**1700**	100
Lead, Total	ug/L	EPA 6010C	10	MCL	15	<10	<10	<10	<10
Lithium, Total	ug/L	EPA 6010C	10	HBLS	10	<10.0	<10.0	<10.0	<10
Magnesium, Total	mg/L	EPA 6010C	2	—	—	43	27	35	35
Manganese, Total	ug/L	EPA 6010C	10	HBSL, SMCL	300, 50	25	**81**	22	**300**
Fall 2025 Baseline Parameters	**Units**	**Method**	**PQL**	**Type**	**Value**	**MON00022**	**MON10016**	**PRE10007**	**SHE00089**
Nickel, Total	ug/L	EPA 6010C	10	HBSL	10	<10	<10	<10	<10
Potassium, Total	mg/L	EPA 6010C	1	—	—	4.2	2.7	2.2	1.3
Silica, Total	mg/L	EPA 6010C	2.4	—	—	9.6	10	11	12
Silver, Total	ug/L	EPA 6010C	5	HBSL	100	<5.0	<5.0	<5.0	<5.0
Sodium, Total	mg/L	EPA 6010C	0.4	—	—	13	**38**	**23**	9.2
Strontium, Total	ug/L	EPA 6010C	10	HBSL	4,000	500	670	900	460
Vanadium, Total	ug/L	EPA 6010C	10	—	—	<10	<10	<10	<10
Zinc, Total	ug/L	EPA 6010C	10	HBSL	2,000	<10	<10	<10	<10
Antimony, Total	ug/L	EPA 6020A	15	MCL	6	<15	<15	<15	<3.0
Thallium, Total	ug/L	EPA 6020A	5	MCL	2	<5.0	<5.0	<5.0	<1.0
Uranium, Total	ug/L	EPA 6020A	50	MCL	30	<50	<50	<50	<10
Alkalinity, Total (pH 4.5)	mg/L	SM 2320B-97,11	5	—	—	370	240	290	280
Solids, Dissolved	mg/L	SM 2540C-20	20	SMCL	500	**626**	394	364	370
Chromium, Hexavalent	ug/L	SM 3500-Cr B-20	4	MCL	100	<4.0	<4.0	<4.0	<4.0
Orthophosphate as P	mg/L	SM 4500 P ,E-21	0.01	—	—	<0.01	<0.01	<0.01	<0.01
Orthophosphate as PO4	mg/L	SM 4500 P ,E-21	0.03	—	—	<0.03	<0.03	<0.03	<0.03
Fluoride	mg/L	SM 4500-F B,C-11, SM 4500-F C-97	0.1	MCL	4	0.187	0.137	0.189	0.354
Nitrate/Nitrite-N	mg/L	SM 4500-NO3 F-19	0.5	MCL	10	<0.50	<0.50	<0.50	<0.50
Nitrite-N	mg/L	SM 4500-NO3 F-19	0.05	MCL	1	<0.05	<0.05	<0.05	<0.05
Phosphorus, Total	mg/L	SM-4500P B,E-21	0.04	—	—	<0.04	<0.04	<0.04	<0.04
Carbonaceous BOD	mg/L	SM 5210 B-16	2	—	—	<2.0	<2.0	<2.0	<4.0
Total Organic Carbon	mg/L	SM 5310B-00,14	0.7	—	—	1.2	0.8	<0.7	<0.7
E. coli	MPN/100mL	SM-9223 B	1	MCL	0	<1	<1	<1	<1

Fall 2025 Baseline Parameters	Units	Method	PQL	Type	Value	WAR10003	WAR10004
Dissolved Oxygen	mg/L	Field Measured	—	—	—	0.00	0.71
Oxidation Reduction Potential	mV	Field Measured	—	—	—	-144.5	45.1
pH	S.U.	Field Measured	—	SMCL	6.5 - 8.5	7.37	7.53
Fall 2025 Baseline Parameters	**Units**	**Method**	**PQL**	**Type**	**Value**	**WAR10003**	**WAR10004**
Specific Conductance	mS/cm	Field Measured	—	—	—	1056	557
Temperature	°C	Field Measured	—	—	—	14.5	14.8
Total Kjeldahl Nitrogen	mg/L	EPA 351.2	0.5	—	—	<0.50	<0.50
Hardness (Calc. as CaCO3)	mg/L	EPA 200.7 Rev. 4.4	5	—	—	436	259
Chloride	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	**130**	**39**
Sulfate	mg/L	EPA 300.0 Rev 2.1	5	SMCL	250	87	23
Cyanide, Total	mg/L	EPA 335.4 Rev. 1.0	0.005	MCL	0.2	<0.005	<0.005
Ammonia-N	mg/L	EPA 350.1 Rev. 2.0	0.05	—	—	0.28	<0.05
Nitrate-N	mg/L	EPA 353.2 Rev. 2.0	0.5	MCL	10	<0.50	<0.50
Chemical Oxygen Demand	mg/L	EPA 410.4 Rev 2.0	10	—	—	17	<10
Phenolics (as Phenol), Total	mg/L	EPA 420.4 Rev. 1.0	0.05	—	—	<0.05	<0.05
Aluminum, Total	ug/L	EPA 6010C	150	HBSL, SMCL	70, 50	<150	<150
Arsenic, Total	ug/L	EPA 6010C	10	MCL	10	<10	<10
Barium, Total	ug/L	EPA 6010C	10	MCL	2,000	200	61
Beryllium, Total	ug/L	EPA 6010C	5	MCL	2	<5.0	<5.0
Boron, Total	ug/L	EPA 6010C	50	HBSL	5,000	220	65
Cadmium, Total	ug/L	EPA 6010C	5	MCL	5	<5.0	<5.0
Calcium, Total	mg/L	EPA 6010C	2	—	—	110	57
Cobalt, Total	ug/L	EPA 6010C	10	HBSL	2	<10	<10
Copper, Total	ug/L	EPA 6010C	10	MCL	1,300	<10	<10
Iron, Total	ug/L	EPA 6010C	40	HBSL, SMCL	4,000, 300	**2200**	<40
Lead, Total	ug/L	EPA 6010C	10	MCL	15	<10	<10

Lithium, Total	ug/L	EPA 6010C	10	HBLS	10	<10.0	<10.0
Magnesium, Total	mg/L	EPA 6010C	2	—	—	41	28
Manganese, Total	ug/L	EPA 6010C	10	HBSL, SMCL	300, 50	**64**	<10
Nickel, Total	ug/L	EPA 6010C	10	HBSL	10	<10	<10
Potassium, Total	mg/L	EPA 6010C	1	—	—	2.7	2.5
Fall 2025 Baseline Parameters	**Units**	**Method**	**PQL**	**Type**	**Value**	**WAR10003**	**WAR10004**
Silica, Total	mg/L	EPA 6010C	2.4	—	—	15	8.8
Silver, Total	ug/L	EPA 6010C	5	HBSL	100	<5.0	<5.0
Sodium, Total	mg/L	EPA 6010C	0.4	—	—	**57**	**23**
Strontium, Total	ug/L	EPA 6010C	10	HBSL	4,000	1200	430
Vanadium, Total	ug/L	EPA 6010C	10	—	—	<10	<10
Zinc, Total	ug/L	EPA 6010C	10	HBSL	2,000	<10	<10
Antimony, Total	ug/L	EPA 6020A	15	MCL	6	<3.0	<3.0
Thallium, Total	ug/L	EPA 6020A	5	MCL	2	<1.0	<1.0
Uranium, Total	ug/L	EPA 6020A	50	MCL	30	<10	<10
Alkalinity, Total (pH 4.5)	mg/L	SM 2320B-97,11	5	—	—	300	220
Solids, Dissolved	mg/L	SM 2540C-20	20	SMCL	500	**626**	256
Chromium, Hexavalent	ug/L	SM 3500-Cr B-20	4	MCL	100	<4.0	<4.0
Orthophosphate as P	mg/L	SM 4500 P ,E-21	0.01	—	—	<0.01	<0.01
Orthophosphate as PO4	mg/L	SM 4500 P ,E-21	0.03	—	—	<0.03	<0.03
Fluoride	mg/L	SM 4500-F B,C-11, SM 4500-F C-97	0.1	MCL	4	0.205	0.216
Nitrate/Nitrite-N	mg/L	SM 4500-NO3 F-19	0.5	MCL	10	<0.50	<0.50
Nitrite-N	mg/L	SM 4500-NO3 F-19	0.05	MCL	1	<0.05	<0.05
Phosphorus, Total	mg/L	SM-4500P B,E-21	0.04	—	—	<0.04	<0.04
Carbonaceous BOD	mg/L	SM 5210 B-16	2	—	—	2.1	<2.0
Total Organic Carbon	mg/L	SM 5310B-00,14	0.7	—	—	<0.7	<0.7
E. coli	MPN/100mL	SM-9223 B	1	MCL	0	<2	<1

MCL – Maximum Contaminant Level set by USEPA

SMCL – Secondary Maximum Contaminant Level set by USEPA
HBSL – Non enforceable Health Based Screening Level based on (1) latest USEPA Office of Water policies for establishing drinking water benchmarks and (2) most recent USEPA peer reviewed toxicity information
— No drinking water benchmark set for the compound
J – Estimated value
B – Analyte was detected in method blank at or above method reporting limit
Numbers in bold exceed a benchmark and/or likely reflect anthropogenic sources

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